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TRAUMATIC RETROPERITONEAL RUPTURE OF THE DUODENUM

DESCRIPTION OF A VALUABLE ROENTGEN OBSERVATION IN ITS RECOGNITION

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THE duodenum, being protected by the liver, colon, transverse mesocolon, the mesenteric root, and the lower thorax, is but rarely ruptured by blunt traumatism of the abdominal wall. However, when the trauma is severe, the fact that the duodenum is fixed to the rigid spinal column favors its rupture. Only the uppermost first portion of the duodenum possesses a complete peritoneal covering. The second and third portions are covered by peritoneum on their anterior aspect only. Hence the anatomic classification of retroperitoneal and intraperitoneal duodenal rupture.

In 1895 Petry estimated the number of traumatic duodenal ruptures at 5 per cent of the injuries of the gastro-intestinal canal. In 1907 Hertle estimated its occurrence at about 10 per cent. Counsellor, at a more recent date, also stated that the duodenum is involved in about 10 per cent of all cases of traumatic rupture of the bowel. In 1922 Furtwaengler gathered 118 cases. The incidence of duodenal rupture no doubt has increased tremendously with the increasing incidence of automobile accidents.

The prognosis is, generally speaking, bad. Furtwaengler observed 14 recoveries in 118 cases (11 per cent). Schumacher, in 1910, estimated the mortality to be 90 per cent. Berry and Giuseppi (1908) reported a mor-

tality of 87.2 per cent in a series of 132 cases of traumatic perforation of the intestine. Of 23 cases of duodenal rupture reported by them, three were retroperitoneal. Schumacher collected 91 cases of subcutaneous rupture of the duodenum, 23 of them retroperitoneal. In 14 of 29 cases collected by Söderlund the site of the perforation was not discovered at the time of the operation. In 15 of the cases reported by Berry and Giuseppi the site of rupture was not found at operation.

Because this serious complication may be overlooked even at operation, emphasis must be laid on any helpful symptom or sign which might give a clue to the correct diagnosis. Harris has emphasized that in retroperitoneal rupture of the duodenum, crepitation of the retroperitoneal tissues is found. Butler and Carlson report a case in which gas could be palpated in the pelvic tissues on rectal examination. They add that, on making an abdominal incision, when gas or air is found between the peritoneum and the transversalis fascia in a patient who has suffered abdominal injury, retroperitoneal rupture of a hollow viscus should be suspected. They also call attention to severe testicular pain which may occur; this they attribute to irritation of the testicular nerves by bile and duodenal juices in the retroperitoneal space.

So far as we can determine, there have

been no case reports in the literature in which the diagnosis was made largely by roentgen examination. In recent years

between the liver and the lateral abdominal wall. Furthermore, an antero-posterior film of the abdomen with the patient supine



Fig. 1. Roentgenogram of abdomen 24 hours after injury. Gas collected about right kidney, right psoas muscle, and retrocecal region is shown (arrows). Note bubble-like character of shadows, characteristic of emphysema of tissues rather than free gas.

roentgen examination of the abdomen in all patients suspected of having a perforation of a hollow viscus has been generally adopted. In this clinic films made with the patient upright are usually obtained to demonstrate free gas in the peritoneal cavity; the gas should extend beneath the diaphragms and be delineated in this position. In addition, postero-anterior roentgenograms with the patient lying on the left side are made to demonstrate, if possible, gas

is obtained to determine the presence of gas in the intestine and its distribution.

We wish to report a case of retroperitoneal rupture of the duodenum in which, because of the routine procedure outlined above, the diagnosis was made by the roentgen observation of gas about the right kidney. Recovery occurred under a régime of conservative therapy without operation.

Case 1. R. R., a boy, aged 19, was admitted to the hospital on May 18, 1934,

with the history of having been kicked in the mid-epigastrium by a horse 20 hours before admission. He had been thrown to the ground and was unable to stand. The patient suffered sudden excruciating abdominal pain which became progressively worse. He vomited several times. There was severe hematemesis on the morning of admission. Dysuria but no hematuria was present.

On examination 20 hours after injury the patient was not in shock. The blood pressure was 124/80 mm. Hg, temperature 100.4 degrees, pulse 100 and of good quality. The head and neck were essentially negative, and the chest was clear. There was marked tenderness and rigidity of the upper abdomen, more marked on the right. Rebound tenderness was present. There was tenderness in the right lumbar region. On rectal examination there was tenderness high on the right.

Laboratory Findings.—Hemoglobin, 100 per cent; leukocytes, 14,900; neutrophils, 89 per cent. Blood, Group 2. Urine, numerous white blood cells in sediment.

Roentgenograms of the abdomen, made with the patient in the erect posture, did not reveal the presence of gas under the diaphragm. There was some separation of the liver edge from the lateral abdominal wall. This was attributed to the presence of intraperitoneal hemorrhage, most likely from the liver. A large amount of gas was seen accumulated about the right kidney and this was interpreted as representing an emphysema of the retroperitoneal tissue (Fig. 1). This was in the form of bubbles and striations as would be expected with air in the tissue, but not free in any cavity. The gas did not change in position with shifting of the patient. A diagnosis of retroperitoneal rupture of the duodenum was made. Because of the long history (20 hours) and because rupture of an intraperitoneal hollow viscus could be ruled out (no free gas in the peritoneal cavity), conservative therapy was instituted. There appeared to be no increase in the gas outside the bowel as indicated by another postero-anterior scout film of the abdomen made

some hours after the institution of suction, which finding seemed to justify continuance of conservative treatment. Heat was ap-



Fig. 2. Roentgenogram of stomach and duodenum, with barium meal, five months after recovery, showing deformity of second portion of duodenum (arrow) incident to healing of rupture.

plied to the abdomen, and fluids were given para-orally. The patient was carefully observed for evidence of further bleeding. The general condition remained good. By the third day the temperature had risen to 103 degrees, and then gradually it subsided to normal. An adequate fluid intake—3,000 to 5,000 c.c. daily—was assured by intravenous and subcutaneous administration of 5 per cent glucose in normal saline solution. Duodenal suction siphonage was instituted with nasal tube, and the fluid drainage was restored to the patient by proctoclysis.

Duodenal suction siphonage was discontinued on the tenth day after admission. The patient was gradually put on a full diet. He was up and about on the twelfth day, and was discharged 13 days after admission. Roentgen examinations three days and six days after admission showed a diminution of the amount of air surrounding the kidney. An examination three weeks following the injury revealed only a very small amount of gas present about the

lower pole of the right kidney. The kidney outline was normal. Later, roentgen examination of the stomach and duodenum with the barium meal revealed a marked irregularity of the second portion of the duodenum, due, no doubt, to the scar from the perforation (Fig. 2).

COMMENT

The presence of gas in the retroperitoneal tissues could occur in only three ways: by artificial introduction, by an infection with a gas-forming organism, and by rupture of a hollow viscus which has a retroperitoneal course. It was obviously unnecessary to consider the first possibility. The absence of an external wound made the second possibility extremely improbable. The clear history of trauma, the symptomatology which suggested a ruptured viscus, the absence of free gas in the peritoneal cavity as shown by roentgen examination all pointed clearly to rupture of a viscus into the retroperitoneal tissues about the kidney. The presence of the gas on the right side only, in exactly the position in which the second portion of the duodenum extends retroperitoneally, strongly suggests a rupture of this segment of the bowel. That a retroperitoneal portion of the ascending colon may have been the source of the gas escape cannot be positively excluded, but yet remains unlikely in view of the subsequent finding of the deformity in the duodenum. The location of the initial injury is also much in favor of duodenal rupture. The gradual absorption

of the gas and the characteristic deformity of the duodenum, observed later on roentgen examination, clearly confirm the original diagnosis. This case demonstrates a roentgen sign of perforation of the duodenum which may be of great value in the early diagnosis of this condition.

SUMMARY

A case of retroperitoneal rupture of the duodenum diagnosed by roentgen examination, with spontaneous recovery, is reported.

Attention is directed to the value of the roentgen finding, of emphysema of the perirenal tissues, as a helpful diagnostic sign of retroperitoneal rupture of a hollow viscus.

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PRIMARY APICAL LUNG CANCER PRODUCING THE SYMPTOMATOLOGY OF A SUPERIOR PULMONARY SULCUS TUMOR

REPORT OF A CASE

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MALIGNANT tumors of the pulmonary apex and thoracic inlet have been studied intensively within the last five years. Opportunity to examine autopsy material from a case with the symptomatology, clinical and roentgenographic findings of superior pulmonary sulcus tumor confirms the belief that this tumor arose from the mucosa of the terminal bronchioles in the apex of the lung. The clinical features of this condition are entirely different from those of carcinoma arising in a large bronchus of the upper lobe, probably because of location and mode of spread.

CASE REPORT

A steel worker, 46 years of age, white, was admitted to the Western Pennsylvania Hospital, March 8, 1937, complaining of cough, hemoptysis, and pain in the right upper chest and arm. His health had been good until six years previously, at which time he suffered a "nervous breakdown." While working in a mill he fainted and was carried home, where he remained for six weeks. He was told he had low blood pressure but was permitted to return to work and was in good health until September, 1936.

In September he began to cough frequently and raise bloody sputum. Shortly afterward he developed pain in the right clavicular region which radiated down the arm to the elbow. These symptoms became progressively worse, the cough had been especially severe the last two weeks before admission, and the pain had radiated down to the hand since January, 1937. This pain was so severe that it interfered with his sleep, made it difficult for him to use his right hand, and was not relieved by narcotics. He had lost some weight, but

complained of no dyspnea. He was referred from a tuberculosis sanatorium where he had remained three weeks.

The past and family histories were irrelevant.

Upon examination the patient appeared emaciated, cachectic, and very weak. Horner's syndrome was present on the right presenting a ptosis of the lid and contraction of the pupil. The right eye reacted sluggishly to light, the left appeared normal. The anterior cervical lymph nodes were palpable bilaterally. There was fullness and tenderness of the right supra- and infraclavicular fossæ, with a hard, fixed mass. The superficial veins of the right upper chest and neck were dilated. The upper right chest showed diminished excursion and dullness to the level of the third rib anteriorly. Breath sounds were absent in the apex, and there was bronchial breathing in the first and second interspaces anteriorly. No râles were heard, and the rest of the right lung appeared hyper-resonant with exaggerated breath sounds. The left lung seemed normal. Definite clubbing of the fingers was noted, and there were palpable lymph glands in the right axilla. There was muscular wasting of the arms and forearms, worse on the right. The systolic blood pressure was 98, the diastolic 66. No sputum could be obtained for examination. Urinalysis showed a 1 plus albumen, 12 to 15 white blood cells per high power field, and occasional granular casts. The hemoglobin was 80 per cent; the red blood cell count was 4,000,000, and the white blood cell count was 22,000 per cubic millimeter. The differential count was polynuclear cells 83 per cent, small lymphocytes 9 per cent, large lymphocytes



Fig. 1-A.

Fig. 1-A. Chest, bedside examination, showing advanced lesion in the right apex. Note infiltration and cavitation at lower border of mass.



Fig. 1-B.

Fig. 1-B. Shoulder, demonstrating density in apex and neck with destruction of the right first two ribs and vertebrae.

9 per cent, transitional cells 5 per cent, myelocytes 2 per cent. Blood chemistry showed a non-protein nitrogen of 53 mgm. per 100 c.c. (normal value 26-40); creatinine and sugar within normal limits. The blood Kahn reaction was negative.

X-ray examination of the chest upon admission revealed a soft tissue tumor and cavitation in the right upper lobe, with destruction of the posterior portion of the first and second ribs and some erosion of the transverse processes of the right vertebral border. There was no involvement of the scapula or clavicle. A diagnosis of superior pulmonary sulcus tumor was made (Fig. 1).

The Tumor Clinic recommended surgical measures for the relief of pain, since radiation therapy probably would not control the symptoms. Consequently, a high left cervical (third) chordotomy and right

fifth, sixth, and seventh cervical rhizotomies were performed. At operation there was a thin layer of grayish, lobulated soft tissue which appeared to be tumor tissue, outside the dura at the lower end of the wound. During the post-operative course the patient suffered considerable pain and grew steadily weaker. He died one month after admission, or seven months after the onset of the disease. Necropsy was performed six hours after death.

Necropsy (A-99): Gross Anatomy.—The body was that of a well developed, emaciated, white male 46 years of age, 179 cm. long. There was a marked fullness of the neck above the lateral half of the right clavicle and a firm, nodular mass about 4 cm. in diameter could be palpated in this position. It seemed to arise from beneath the clavicle as the lower margin could not be identified. The chest and abdomen

showed no abnormalities. There were decubitus ulcers posteriorly over the right shoulder and buttock.

The upper lobe of the right lung appeared greatly enlarged, occupying nearly two-thirds of the right chest cavity. This increase in size was due to a globular mass 10 cm. in diameter situated in the apex and smoothly continuous with the rest of the upper lobe. The entire external surface of the lung, including the apical enlargement, was smooth and grayish-black. The lower lobe was bound to the chest wall laterally and posteriorly by fibrous adhesions, while the mass in the upper lobe was so tightly adherent over its entire posterior surface that it could be removed only by sharp dissection (Fig. 2).

The upper lobe, exclusive of the globular enlargement, was almost normal in size, measuring $5 \times 13 \times 16$ cm. Crepitanity was elicited throughout the upper lobe except in the region of the mass, which was exceedingly firm and tense. The cut surface of the latter revealed a rounded, sharply defined, non-encapsulated mass of soft, exceedingly friable, slightly granular tissue which varied in color from white to yellowish-white. The pure white areas were of an almost homogeneous smoothness, while the yellowish-white portions were usually finely granular. A few very soft, degenerated, brownish-pink areas were also present.

Anteriorly and on both sides this mass was surrounded by a paper-thin envelope of lung tissue. Posteriorly, it was adherent to the ribs and had invaded and destroyed the first three ribs for a distance of two or three centimeters from the vertebral border laterward and had also produced slight roughening of the sides of the corresponding vertebrae. Superiorly, it was continuous with the nodular mass palpable above the clavicle. (The latter was not removed due to restrictions in the autopsy permission.) Inferiorly, the edge of the white tissue was rounded and sharply delimited from the adjoining lung. A medium sized bronchus entered the mass through the inferior border, but ended blindly almost immediately.



Fig. 2. Right lung showing apical tumor (light colored portion). Tumor is ragged and collapsed due to difficulty of removal.

The cut surface of the rest of the upper lobe was dry and gray; that of the lower and middle lobes was reddish-gray and moist, with a few small, slightly raised yellow foci of bronchopneumonia. There was no lesion of the left lung. The other organs were normal except for an acute splenitis. No metastases were found.

Microscopic Anatomy.—The mass at the right apex was composed of irregular islands of epithelial cells separated by a scanty amount of stroma. The cell masses varied greatly in size and shape, but the majority were quite large, frequently being long and winding, so that a papillary structure was simulated. In a few areas these epithelial islands were made up largely of prickly cells and usually contained an epithelial pearl in the center. In the majority of the sections, however, prickly cells and epithelial pearls were absent and the cells varied from polygonal to spindle in shape, the larger cells being found in the center of the islands.

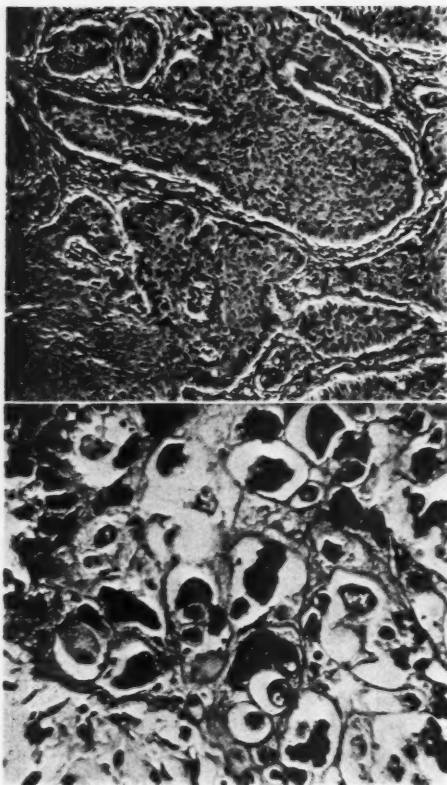


Fig. 3-A (upper). Low power view of typical microscopic field ($\times 100$).

Fig. 3-B (lower). High power of same ($\times 500$). Note the marked cellular variation and giant nuclei.

The individual cells varied greatly in size and shape, but were usually large with pale cytoplasm and large vesicular nuclei. The latter were frequently multilobed, the number of lobes varying from two to ten. Enormous, bizarre, hyperchromatic nuclei were very common and formed the most prominent feature of the sections. Mitotic figures were numerous in all areas (Fig. 3).

Diagnosis.—Squamous-cell carcinoma, originating in the apex of the right lung, and invading the ribs, vertebræ, and soft tissues of the neck.

COMMENT

The treatment of malignant tumors of the pulmonary apex and thoracic inlet is notoriously unsatisfactory. The progno-

sis is hopeless, and satisfactory palliation is difficult to obtain. The characteristic pain can be relieved sometimes by physical therapeutic measures or alcohol injection, but the relief even with intensive roentgen therapy is usually only temporary. In our patient, although the disease was so far advanced, enough relief from the terrific pain resulted to justify chordotomy and rhizotomy.

Opinion regarding the origin of these tumors varies widely. A large proportion of so-called superior pulmonary sulcus tumors appear to be lung carcinoma, often of the squamous-cell type. But in our case and in other reported cases it is difficult to explain why a tumor originating in the apex of the lung should show such extensive involvement of the ribs, vertebræ, and soft tissues of the neck, when a large portion of the upper lobe of the lung is entirely uninvolved. On the other hand, it is unlikely that a tumor originating in the neck would invade the apex of the lung so consistently.

However, this same general location could be the site of tumors arising in structures of the neck, such as sympathetic ganglia, or persistent branchial cleft tissue. Perhaps firm apical adhesions would tend to facilitate extension to the lung. The clear-cut symptomatology and clinical and roentgenographic findings of superior pulmonary sulcus tumors would, therefore, seem to be related more to the location of the tumors than to any uniform histogenesis. In this connection, however, it must be remembered that the appearance of lung carcinomas may be exceedingly diverse, and undifferentiated carcinomas may simulate other types of neoplasm.

In our case about two-thirds of the tumor was intrathoracic and definitely encapsulated by lung tissue except posteriorly. A bronchus was traced into the tumor mass. There seems to be no reasonable doubt that it arose in the lung.

SUMMARY

1. A case of primary carcinoma of the lung occurring in the apex, which supports

the view that "superior pulmonary sulcus tumors" are primary carcinomas of the lung, is described.

2. Superior pulmonary sulcus tumor is not a new specific pathologic entity among intrathoracic neoplasms, but the symptoms and signs may be caused by various tumors arising near the thoracic inlet.

3. Surgical measures for the relief of pain offer valuable palliation in some cases.

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DEMONSTRATION OF GAMMA RADIATION FROM LIVING PATIENT FOLLOWING THOROTRAST INJECTION¹

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SINCE the introduction of thorotrast several years ago, it has been well received by the profession for the purpose of intravenous injection as a contrast medium to delineate the liver and spleen on the radiograph, but as thorium is one of the more radio-active elements, the question naturally arose as to the probability of its radiation doing damage to the reticulo-endothelial system after many years of bombardment.

I believe that I have definitely shown that the radio-activity from this preparation is well within the limits of danger.

The Geiger Counter (1) has opened great possibilities in the measurement of small quantities of radiation. Perhaps it is no exaggeration to say that it does the same thing for the radiologist that the microscope does for the biologist. Briefly, it consists of a glass tube which is partly evacuated and has a cathode charged to a



Fig. 1. The author's Geiger Counter as used in this work. The Locher tube in the metal shield can is placed on the body of the patient against the liver. Radiation causes the entrance of an occasional photo-electron into this tube. The feeble impulse is amplified by the radio tubes sufficiently to actuate the relay, which, in turn, operates the signal light and the mechanical counter.

One writer has dismissed the matter with the statement that the radiation is negligible. Others have reached that conclusion by placing the material on a photographic film for a few hours, and, when no blackening occurred, assuming that the human body could not be damaged.

fairly high potential. The anode is connected to a system of amplifying tubes so that the feeble impulse of a photo-electron entering the tube becomes sufficiently powerful to operate a loud speaker, signal light, or mechanical counting device. The delicacy of this instrument is shown by the fact that it responds well to a 10 mg. needle of radium at a distance of more than one hundred feet. When a sealed ampule of

¹ Presented as a clinic at the Twenty-second Annual Meeting of the Radiological Society of North America, at Cincinnati, Nov. 30-Dec. 4, 1936.

thorotrast is brought near this instrument, the response is immediate and violent.

Realizing that the accurate determination of the gamma-ray activity of a dose of thorotrast would be of value, I started work on the problem. A small standard of radium was obtained, not anything comparable to radium needles such as are used medically, but a crude radium salt containing three micrograms of radium element. To make this amount intelligible to the radiologist who is in the habit of dealing with milligrams, it is well to state that this standard represents an investment of about twenty-four cents. This standard was compared with the three ampules of thorotrast as follows: in a room where there was no known radio-activity and at a time when no x-ray machines were in operation, the Geiger Counter was allowed to make a base count which, of course, included cosmic radiation and any small amount of radiation which may have emanated from the soil or building. This count varies at different locations but, once established, is used as a correction factor on the instrument.

Next, the thorotrast is placed on a wooden frame along with the counting tube, the distance being an arbitrary one, but one which can be exactly duplicated. Counts are made over a long period of time so that the average per minute can be determined. After this, the radium standard is placed in the same position formerly occupied by the thorotrast and its average per minute count determined.

The base count is subtracted from the count on thorotrast and from the count on the radium, after which the counts are arranged in a proportion with the known standard in the micrograms of radium, and the unknown value in micrograms of radium equivalent of thorotrast solved.

These tests, repeated many times, showed that 75 c.c. of thorotrast gave the gamma radiation equivalent to 1.37 microgram of radium. To the radiologist who uses a hundred milligrams or more in the treatment of diseases, this small amount of radium may appear inconsequential, but

let us consider a moment. This much radio-active material is put in the human body where it remains permanently, the association not even being terminated, as are other human associations, "when death do us part." This is demonstrated by the test tube full of white powder which was once a human liver, removed at autopsy and burned down to white ashes and still showing radio-activity. Throughout the patient's life, this material would continue to radiate the body, not as a surface application of radium but from the *inside* of the cells, where not only the gamma radiation which I have demonstrated would be effective, but with alpha and beta radiation as well. Attention is called to the fact that thorium gives more alpha radiation in proportion to its gamma radiation than does radium and that the life of thorium in this form is so long that it would not appreciably diminish in an individual's lifetime.

The demonstration of radio-activity in the liver of a living patient who has previously been injected with thorotrast is a rather spectacular one. I have been able to do this with only a fair degree of accuracy because the material is so disseminated that it is impossible to use the body radiation as though it were coming from a small mass. To arrive at some kind of a standard of radiation from which to work, I made the "Phantom Liver." This is a hollow wax cast molded on a liver, cut in half and the liver removed, the cast sealed back together and then filled with 75 c.c. of thorotrast and water in sufficient quantity. This gave an object the size and shape of the liver with the 100 per cent dose. Counts were made on this and then on the body of the patient and a proportion arrived at.

The final test of the situation came when I was able to get an autopsy on a patient who died of leukemia about six weeks after having been injected with thorotrast, and on whom I had made observations during life. The liver, when burned to ash so as to get it into a small mass, showed activity equivalent to 50 per cent the original dose; and the spleen, about 12 per cent.

Some small amount is lost by excretion and the remainder is assumed to be scattered throughout the body.

The question which may now be logically asked is, what is the basis for assuming that so small an amount of radioactive material can be harmful? The answer is obvious to anyone who will take the trouble to review the work of Martland (2) in the studies of those unfortunate individuals who were poisoned by radium salts in the dial painting industry. In these accidents, we had a series of unintentional experiments which will certainly never be repeated, but which answered many of the questions about radium poisoning.

To summarize very briefly, *two* micrograms in the body have produced symptoms of radium poisoning, and *fourteen* micrograms have caused death.

Since this work was first presented, I have received a personal communication

from a physicist (3), stating that he has studied a body in which death was caused by 1.2 microgram.

With this knowledge on hand, does the radiologist, for diagnostic purposes, still want to inject the equivalent of 1.37 microgram radium?

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EFFECT OF X-RAYS ON THE OXYGEN CONSUMPTION OF EMBRYONIC CELLS¹

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THAT different tissues and cells respond to irradiations in various ways seems well established (Packard, 21; Duggar, 7, and others). It is also equally well known that radiosensitivity seems in some way connected with or dependent upon the physiological activity of the cells at the time of irradiation as well as upon their subsequent history after exposure (Duggar, 7; Henshaw and Henshaw, 12, 14; Henshaw and Francis, 11, 16, 17, 18, 19; Evans, 8, 9, 10, and others). In many instances, however, conflicting data have been reported by different authors working on similar materials. The exact nature of the effects produced upon protoplasm by irradiation seems as yet obscure due perhaps to the complexity of protoplasm itself as well as to the lack of suitably controlled biological materials and methods with which to work.

The present paper is concerned with the results of experiments on the effects of x-rays on the growth, oxygen intake, oxidation enzymes, and hatching of the egg and embryo of the common grasshopper, *Melanoplus differentialis*. Of the many special advantages in the case of this biological material, perhaps none is more striking than the fact that a naturally occurring developmental block takes place in the embryo which can be more or less experimentally controlled so that all physiological conditions from a complete lack of mitosis, cessation of growth, etc., to a marked cellular activity can be easily obtained. These phenomena have been fully described elsewhere (Bodine, 1, 2, 3) and need not be enumerated again except insofar as

necessary in connection with descriptions of individual experiments. The particular problem to be considered here is the extent to which the normal oxygen uptake mechanism of the embryonic cell is influenced, if at all, as the result of x-ray irradiation.

MATERIAL AND METHODS

Methods of handling eggs and embryos were the same as previously pointed out (Bodine and Boell, 6). Oxygen determinations have been carried out in triplicate with Warburg manometers at 25° C., using some 500–600 eggs and embryos in each experiment. Inasmuch as the results of all experiments are qualitatively similar, only typical results will be presented.

The x-ray apparatus was the same as that employed in previous investigations (Evans, 10). The radiation (130 kv., 5 ma., and 35 cm. distance) was applied in one treatment and the amounts were determined by varying exposure time.

I. *X-rays on Diapause or Blocked Eggs and Embryos*.—In considering the results of the effects of x-rays on the diapause or blocked embryo, it is well to keep in mind the facts that in this condition the O₂ intake is at a minimum, cell division (mitosis) is absent, growth does not occur, and that this blocked condition is a naturally occurring phenomenon, inherent in the cells of the embryo and quite independent of external temperature for its occurrence. (See Bodine and Boell, 4, for further details.)

Diapause eggs (exposed to temperature of 25° C. for 56 days from time of laying) were divided into two groups. One lot served as control while the other was x-rayed with 2,040 r units (170 r per min. for 12 min.). Both were kept at 25° C. and samples taken at intervals to determine

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their oxygen intake as well as any possible morphological changes. Respiration was determined over a three- to five-hour interval and results are expressed as mm.³ O₂ uptake per 100 eggs per hour. Table I gives results of a typical experiment. Upon examination of this table it will be noted

ured. From an inspection of Table II it will be evident that no significant effects of the irradiation on the contained embryos are apparent.

Not only is the normal respiration of the blocked embryo unaffected by the x-rays of the dosages used, but it can also be

TABLE I.—OXYGEN UPTAKE OF CONTROL AND DIAPAUSE EGGS X-RAYED WITH 2,040 r UNITS (170 r UNITS PER MINUTE FOR 12 MINUTES). RESPIRATION OF EGGS DETERMINED OVER THREE- TO FIVE-HOUR INTERVALS AT 25° C. THREE MANOMETERS WITH CONTROL EGGS: THREE WITH X-RAYED EGGS. ALL EGGS KEPT AT 25° C.

Days after Raying	(mm. ³ O ₂ uptake per 100 eggs per hour)								X-rayed as Percentage of Control
	Control				X-rayed				
	No. 1	No. 2	No. 3	Average	No. 1	No. 2	No. 3	Average	
1	10.4	9.2	9.5	9.7	10.4	10.1	10.0	10.1	104
4	6.8	7.1	6.8	6.9	6.8	7.2	7.2	7.1	103
7	6.6	6.2	6.3	6.4	7.0	6.0	6.7	6.6	103
10	6.2	5.8	6.6	6.2	9.2	7.8	7.6	8.2	132
12	5.0	5.1	..	5.1	5.2	5.6	..	5.4	106

that no appreciable effects of the x-irradiation on the O₂ intake of the diapause eggs are shown over a period of 12 days after the exposure. The blocked or diapause egg apparently is quite resistant to the action of the x-irradiation. Such results are in agreement with those previously reported by Evans (9).

Inasmuch as it has been previously shown that effects on the intact egg are not necessarily similar to those on the contained embryo (Bodine and Boell, 5), experiments were carried out in which the embryos from irradiated diapause eggs were removed and their O₂ intake meas-

shown that the increase in respiration due to the addition of 3,5-dinitro-o-cresol to the inactive embryos is of the same magnitude as for embryos from control eggs. In Figure 1 are graphically shown the

TABLE II.—OXYGEN UPTAKE OF CONTROL AND DIAPAUSE EMBRYOS X-RAYED WITH 2,040 r UNITS. EMBRYOS DISSECTED FROM X-RAYED EGGS INTO RINGER SOLUTION PLUS M/100 PHOSPHATE BUFFER, pH 7.0. 150 TO 175 EMBRYOS PER MANOMETER. RESPIRATION DETERMINED OVER THREE-HOUR INTERVALS

(mm. ³ O ₂ uptake per 100 embryos per hour)							
Days after Raying	Control			X-rayed			X-rayed as Percentage of Control
	No. 1	No. 2	Aver- age	No. 1	No. 2	Aver- age	
5	6.3	6.5	6.4	6.7	7.1	6.9	108
11	5.6	5.2	5.4	5.3	5.6	5.5	102

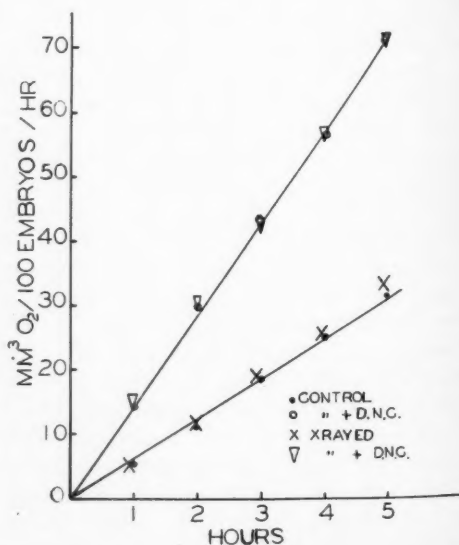


Fig. 1. A graph showing the oxygen uptake of diapause embryos, from eggs treated with 2,040 r units of x-ray, five days after raying; also shows the effect on the oxygen consumption of adding 2×10^{-4} M. 3,5-dinitro-o-cresol to the normal and x-rayed embryos. For further description, see text.

results of the addition of 3×10^{-5} M — D.N.C. on the O_2 intake of control and rayed blocked embryos five days after the exposure to the x-rays.

It would thus seem that the mechanisms controlling the O_2 intake of the blocked embryo as well as the mechanism stimulated by the D.N.C. are in no way impaired by the dosage of x-ray administered. No visible morphological changes have been detected during the period of the experiment.

II. *X-rays on Developing Eggs and Embryos.*—Since mitosis, growth, etc., in the diapause or blocked embryo are normally inhibited by an inherent physiological mechanism which is quite independent of temperature, it was considered advisable to investigate the effects of x-rays on the growing or non-blocked embryo both in the actively growing and experimentally blocked condition. By the use of low temperature (10° C.) growth and mitosis can conveniently be brought to a standstill so that it is thus possible to determine the irradiation effects on respiration independently from those on growth and development.

In preliminary experiments the following procedures were used. Developing eggs containing embryos of stage No. 21 (Slifer, 22) were divided into two groups. One lot was kept as control group, the other x-rayed at room temperature (25 – 27° C.) with 2,040 r units as in the case of diapause eggs mentioned above. The eggs were

then kept at 10° C., at which temperature development is inhibited.

In some cases, as noted in Table III, embryos were dissected out and then rayed in buffered Ringer solution. The Ringer solution was of such a depth (approximately 1 mm.) that the embryos were just covered by the fluid. After raying, they were washed in four changes of fresh Ringer and respiration measured over a period of from two to four hours.

In determining the respiration of the above eggs readings were always taken at 25° C. It was soon found that these exposures to 25° C. caused development to occur sufficiently to allow the control embryos to develop from the fifth post-diapause day stage to the sixth post-diapause day stage. This is evidenced by a steady increase in the respiratory rate of the controls from 41.9 mm.³ O_2 per 100 embryos per hour to 54.0 mm.³ O_2 per 100 embryos per hour. Some development likewise took place in the x-rayed eggs but at a slower rate, so that on the fifth day the controls and x-rayed individuals were no longer morphologically identical. Although, as indicated in Table III, on the fifth day the respiration of the x-rayed embryos is only 82 per cent of that of the controls, this does not indicate a deleterious effect of the x-rays on the respiratory mechanism primarily for no actual decrease in respiratory rate of the x-rayed embryos was observed. It rather suggests that development may be influenced with-

TABLE III.—OXYGEN UPTAKE OF CONTROL AND DEVELOPING EMBRYOS X-RAYED WITH 2,040 r UNITS. EMBRYOS DISSECTED FROM X-RAYED EGGS INTO BUFFERED RINGER WITH EXCEPTION OF THOSE MARKED BY (*) WHICH WERE RAYED DIRECTLY WHILE SUSPENDED IN SOLUTION. EGGS KEPT AT 10° C. RESPIRATION DETERMINED OVER A THREE- TO FIVE-HOUR PERIOD AT 25° C.

Days after Raying	Control				X-rayed				X-rayed as Percentage of Control
	No. 1	No. 2	No. 3	Average	No. 1	No. 2	No. 3	Average	
0*	38.3	39.2	38.3	38.6	37.9	37.9	40.3	38.7	100
0*	42.7	41.4	41.5	41.9	42.5	43.9	42.0	42.8	102
3	48.7	48.2	48.2	48.4	44.3	46.2	46.8	45.8	95
5	53.0	56.0	..	54.0	43.7	43.5	45.0	44.1	82

out affecting respiration. Other experiments to be described below substantiate such a suggestion.

Samples of 50 control and 50 x-rayed eggs were placed at 25° C. in order to follow their development to determine the per cent hatch. Table IV shows results

TABLE IV.—HATCHING DATA FROM DEVELOPING EGGS X-RAYED 2,040 r UNITS AND KEPT AT 25° C. UNTIL HATCHED

Days of Post-diapause Development at 25° C.	50 Control Eggs	50 X-rayed Eggs
16	22	4
17	3	3
20	9	0
21	1	2
	35	9
Percentage of hatch	70	18
Percentage living after hatching	100	0

from one such series and it is to be noted that the x-rayed eggs hatch poorly and most significant is the fact that all such embryos die immediately upon hatching. These results have been found in all experiments and seem to indicate some fundamental effects of the x-ray upon the embryo's development.

Other experiments were carried out on developing eggs in which rigid attention was paid to keeping the eggs at 25° C. for minimal lengths of time. In these, no visible development occurred in controls and x-rayed eggs so that the eggs and embryos at the end of the experiment (15 days after raying) were morphologically identical with those at the beginning.

Two dosages of x-rays were employed, viz., 2,040 and 5,000 r units, and respiration was determined for eggs kept under the following experimental conditions:

- | | | |
|--|------------------------------|------------------|
| (1) Eggs | { control
x-rayed—2,040 r | { kept at 25° C. |
| (2) Eggs | { control
x-rayed—2,040 r | { kept at 10° C. |
| (3) Eggs | { control
x-rayed—5,000 r | { kept at 10° C. |
| (4) Eggs from which embryos were dissected | { control
x-rayed—2,040 r | { kept at 10° C. |

In Table V are given data typical for results found for these series. An inspection of this table shows that in those eggs in which development was permitted at 25° C., subsequent to the exposure to the x-ray, the value of the respiration rate of the experimental eggs decreases over that

TABLE V.—EFFECT OF X-RAYS ON O₂ CONSUMPTION OF DEVELOPING EGGS TREATED WITH DIFFERENT ENVIRONMENTAL TEMPERATURES AFTER EXPOSURE TO IRRADIATION. RESPIRATION DETERMINED OVER A THREE- TO FIVE-HOUR INTERVAL AT 25° C.

Days after Raying	Control			X-rayed		Resp. of X-rayed Eggs as Percentage of Control	
	(1)	(2)	Av.	(1)	(2)	Av.	
	2,040 r—25° C.						
1	69.5	69.5	69.5	68.0	70.7	69.3	100
4	82.5	80.0	81.2	75.5	77.6	76.6	94
6	87.7	87.5	87.6	75.5	78.5	77.0	88
8	80.5	77.5	79.0	73.0	73.0	73.0	93
12	132.0	140.0	136.0	107.7	111.0	109.3	80
15	161.0	158.0	159.5	135.0	131.0	133.0	83
2,040 r—10° C.							
4	60.8	59.0	59.9	55.2	55.7	55.4	93
6	65.0	64.7	64.8	61.0	64.7	62.8	97
8	65.2	65.5	65.4	61.5	60.8	61.2	94
12	64.6	66.2	65.4	63.3	64.8	64.0	98
15	68.0	66.5	67.2	60.0	66.0	63.0	94
5,000 r—10° C.							
1	61.1	62.0	61.5	64.0	65.0	64.5	105
4	66.1	59.0	62.5	60.0	57.2	58.6	94
6	62.2	62.0	62.1	61.2	62.7	62.0	100
8	68.7	65.2	66.9	66.0	63.5	64.7	97
12	68.5	66.0	67.2	63.2	64.6	63.9	95
15	69.0	59.5	64.3	66.5	65.0	65.7	102

Development is going on in these eggs

Development stopped in these eggs

of the control. It might at first hand seem that respiration is primarily affected by the irradiation. However, when de-

son to believe that no significant differences in respiration are brought about in those eggs upon exposure to x-irradiation.

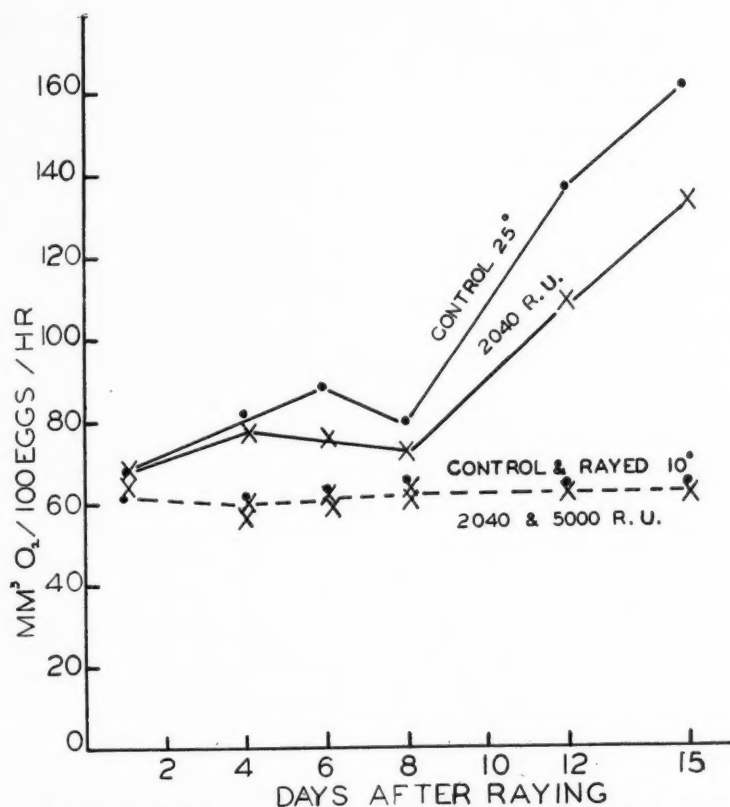


Fig. 2. A graph showing the oxygen uptake of developing eggs exposed to 2,040 and 5,000 r units of x-ray and subsequently kept at 25° C. and 10° C. to permit of active growth on the one hand and to inhibit or check active growth on the other hand. Solid lines for actively growing embryos (25° C.); broken line for inhibited ones (10° C.).

velopment is inhibited at 10° C., it will be noted that no significant change in the respiration rate of control and irradiated eggs is indicated. As a matter of fact, in eggs treated with 2,040 and 5,000 r units, when development is stopped by exposure to 10° C., the average respiratory rate for the controls is 64.3 mm.³ O₂ per 100 eggs per hour and for the rayed eggs it is 62.3 mm.³ O₂ per 100 eggs per hour. The latter figure is 97 per cent of the control value. Since each average is made from a total of 22 individual determinations there is rea-

From Figure 2, graphically showing results of temperature effects, it can readily be seen that when growth is inhibited no differences in the respiration rates of control and irradiated eggs are evident but that in the case of eggs allowed to develop after exposure to x-rays, a gradual falling off in the respiration is observed. This falling off is without doubt due to a cessation or interference with growth and represents no primary effect upon the O₂ intake mechanism as such.

It is also of some interest to again note

(Table VI) that hatching of x-rayed eggs in these series is greatly reduced, and also that, even though some embryos do hatch, they invariably die immediately.

TABLE VI.—HATCHING DATA FROM DEVELOPING EGGS KEPT AFTER X-RAYS (2,040 r UNITS AND 5,000 r UNITS) AT 25° C. AND 10° C. ALL EGGS WERE TRANSFERRED TO 25° C. FOR HATCHING. (a) = EGGS KEPT ONLY AT 25° C. AND GIVEN 2,040 r UNITS; (b) 2,040 r UNITS, KEPT AT 10° C., THEN TRANSFERRED TO 25° C. FOR DEVELOPMENT AND HATCHING; (c) 5,000 r UNITS, KEPT AT 10° C., THEN TRANSFERRED TO 25° C. FOR DEVELOPMENT AND HATCHING

		Total No. of Eggs	No. Hatch	No. Living Nymphs	Per- centage of Total Hatch- ing	Per- centage of Total Living after Hatch- ing
(a)	Control	106	105	99	99	93
	X-rayed	112	23	0	20	0
(b)	Control	101	96	92	95	91
	X-rayed	102	9	1	9	1
(c)	Control	98	88	83	90	85
	X-rayed	99	8	0	8	0

In order to check the above results on the intact egg, embryos were dissected out in buffered Ringer solution and respiration determinations made. Table VII shows

TABLE VII.—EFFECT OF X-RAYS (2,040 r UNITS) ON DEVELOPING EMBRYOS. EGGS KEPT AT 10° C. AFTER EXPOSURE TO IRRADIATION. RESPIRATION OF EMBRYOS DISSECTED FROM EGGS IN BUFFER RINGER SOLUTION DETERMINED OVER A THREE- TO FIVE-HOUR INTERVAL AT 25° C.

(mm.³ O₂ uptake per 100 embryos per hour)

Days after Ray- ing	Control			X-rayed			X- rayed as Per- cent- age of Con- trol
	No. 1	No. 2	Aver- age	No. 1	No. 2	Aver- age	
1	37.6	38.0	37.8	48.4	49.3	48.8	129
4	44.5	43.1	43.8	40.8	37.5	39.2	90
6	38.6	39.2	38.9	36.2	..	36.2	93
12	37.1	39.4	38.2	35.2	40.2	37.7	99
			39.7			41.1	

data typical for embryos from eggs rayed with 2,040 r units and in which development had been inhibited by exposure to 10° C. From an inspection of this table, it will be noted that no significant difference between the respiration of normal and rayed embryos is indicated. As a matter of fact the average respiration of control embryos is 39.7 mm.³ O₂ per 100 eggs per hour and that for rayed embryos, 41.1 mm.³ O₂ per 100 eggs per hour.

In addition to the absence of any effects of x-rays on respiration of eggs and embryos in cases in which development did not occur, there was likewise no effect upon the nature or rate of the contractions of the lateral body walls in rayed embryos. These contractions of the lateral body wall in orthopteran embryos have been used in other experiments in this laboratory (Walker, 24; Thompson, 23) and have been found to be a delicate indication of the physiological responses of the embryos.

Other evidence of the inability of x-irradiation to markedly interfere with the respiration of these embryos is given by following their response to the addition of such respiratory stimulants as 2,4-dinitrophenol. In Figure 3 are graphically shown typical results of the addition of D.N.P. to embryos 12 days after raying. An inspection of this figure clearly indicates that no injurious effects on the mechanisms involved in this reaction seem to have been brought about by exposure of the embryos to x-irradiation.

The many questions involved in the separation of primary and secondary effects of irradiation are undoubtedly complicated by the difficulties inherent in the limitations imposed upon the experimenter by virtue of the complexity of protoplasm itself. The biological material employed in the present experiments seems more or less admirably adapted for getting some clues concerning these questions, since it is relatively simple and its normal course of development and behavior under standard conditions is fairly well known (Slifer, 22). That changes in its radiosensitivity take place during its embryonic development

have been pointed out in work by Evans (8, 9, 10). That the respiration mechanism is perhaps not primarily affected by irradiation seems clear from the results of the present investigation. Correlations of mitotic activity, respiration, etc., seem unlikely since in diapause or blocked embryos no mitosis occurs while respiration is at a minimum. Expressions of change in normal respiration in embryos seem only to occur in those organisms irradiated and subsequently permitted to grow. Such changes would seem to indicate fundamental ones in protoplasmic organization which are secondarily reflected in growth and respiration. Somewhat similar conclusions have been arrived at by Henshaw and Francis (16) working with plant materials.

SUMMARY AND CONCLUSIONS

1. Effects of x-rays on the growth, respiration, and oxidation mechanism of the eggs and embryos of the grasshopper (*Melanoplus differentialis*) have been presented.

2. X-rays in the dosage supplied (2,040, 5,000 r units) do not affect the respiration (O_2 intake) of diapause or blocked embryos.

3. The stimulating action of 3,5-dinitro-o-cresol on oxygen intake of the diapause embryos is not interfered with by x-irradiation.

4. Actively developing eggs and embryos while developing are affected by x-rays as indicated by changes in growth and respiration.

5. X-rays applied to actively developing eggs and embryos in which growth has been stopped by exposure to $10^\circ C$. produce no measurable effect on respiration, or stimulation of respiration by the addition of 2,4-dinitro-phenol.

6. Hatching of actively developing x-rayed eggs is greatly decreased and embryos hatching do not survive.

7. From the results of the present experiment, one is justified in concluding that x-rays (in the dosage used) do not primarily affect the respiration mechanism of the embryonic cell but rather bring

about fundamental changes in protoplasmic organization.

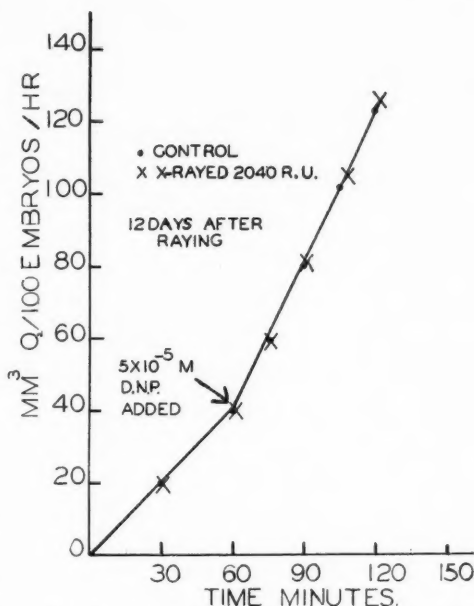


Fig. 3. A graph showing the effect on the oxygen consumption of adding 5×10^{-5} M. 2,4-dinitro-phenol to x-rayed (2,040 r units) developing embryos 12 days after raying. Arrow indicates addition of reagent.

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CANCER OF THE THYROID

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IN this paper I wish to survey the more recent reports on diagnosis, pathologic classification, and treatment of malignancies of the thyroid gland. This subject has received intensive attention at each of the large centers for goiter treatment in this country, where a concentration of thyroid cases naturally leads to the discovery of the small percentage of malignancies among the thousands of cases operated upon.

The majority of the more recent reports on carcinoma of the thyroid sound an encouraging note in their evaluation of the results of treatment. However, as Pemberton (1) points out, "It is apparent that the fatalistic attitude is more widespread concerning this disease than concerning malignancies of other organs of equal accessibility to surgical attack."

Haagenenson (2), in his interesting paper on the radiosensitivity of thyroid tumors, makes an historical survey of methods and results of treatment, from the earlier reports based on surgery alone to the present-day combined methods of surgery and radiation which show markedly improved results.

In the study of comparative results from different centers much confusion is caused by variations in pathologic terminology so that statistical results cannot be closely compared. The peculiar pathologic picture of cancer of the thyroid resulting in histologic sections of wide variability from the same gland, ranging from apparently normal gland to definite malignancy, has resulted in confusion in nomenclature and classification. Almost all authors emphasize the difficulties in diagnosis and apparently no two agree on a standard classification.

Allen Graham (3) offers the following reasons for this unsatisfactory confusion:

(1) The failure in the past to discriminate

sufficiently between "normal" and "adenomatous" thyroid tissue.

(2) The none-too-well appreciated importance of the rôle of the pre-existing adenoma in furnishing the starting point for a very high percentage of epithelial malignancies.

(3) The great number and combinations of names, implying different pathologic entities, applied by various authors to what, in the vast majority of cases, is clearly one and the same pathologic process.

(4) The academically irreconcilable conflict between a purely morphological and a biological interpretation of the term "carcinoma."

(5) The failure to take sufficiently into account the peculiarities of the thyroid as a tissue or special organ, in arriving at what constitutes malignancy.

Incidence of Malignancies of the Thyroid.—Eberts (4) found 20 cases, or 0.9 per cent of malignancy among 2,120 cases examined at the goiter clinic of the Montreal General Hospital. He found 3 per cent of malignancy in 536 cases of adenomatous goiter operated on.

From the Lahey Clinic the latest report, that of Hare (5), gives 258 cases (or 1.7 per cent) diagnosed as primary malignancy of the thyroid gland in 15,000 thyroid operations.

Pemberton reported, in 1928 (6), 323 patients with cancer of the thyroid who constituted 1.03 per cent of patients operated on for goiter.

Clute and Smith, in 1929 (7), quote a number of authorities who give an incidence of from 1 to 5 per cent.

A decisive number of writers who have investigated the subject emphasize the high incidence with which carcinoma develops in pre-existing adenomas of the gland. In general, they report that ap-

proximately 90 per cent of cases originate in a pre-existing adenomatous goiter. However, Eberts (4) mentions several writers who cite cases of carcinoma of the thyroid which apparently occurred in previously normal thyroid tissue. He concludes that such cases do occur, but that in comparison to the number of carcinomas which arise in previously existing lesions, it is rare to find them.

Clute and Warren in a discussion of this question (8) say that the figures are open to a certain amount of question because of fallacious observations by patients. They find, however, that for the cases belonging to their pathologic Groups I and II, a pre-existent goiter was almost invariably present, while in Group III cases often no goiter was noted longer than a few weeks or months before operation.

Age at Onset of Malignancy.—This question has received considerable attention because of its relation to the period of physiological activity of the thyroid gland and also because of the interest attached to several reported cases in children.

All authorities agree that the majority of cases occur in the fifth and sixth decades of life, past the age of greatest physiological activity of the thyroid and sex glands.

Because of the youth of the patient whose description I am appending to this paper, I have paid particular attention to reports of cases in children.

Kennedy (10), in 1935, reported on the cases of carcinoma of the thyroid in children found among the cases operated upon by Pemberton at the Mayo Clinic. In 276 operative cases he found one patient in the first decade and two in the second decade. He found six cases reported in the American literature in twenty years.

In a more recent report, Hare (5) found six cases of primary malignancy of the thyroid in children under fourteen years of age among 258 cases of children operated on at the Lahey Clinic. Three of these cases had previously been reported by Cattell in 1932 (11). Cattell noted the dissimilarity of his cases and concluded that those corresponding in type and

grade to malignancies in adults have similar clinical courses.

Hare reports excellent results from combined surgery and radiation in his cases, especially so since his plan of radiation was changed by increasing filtration and protracting treatment to allow of larger total dosage with less skin damage. This discussion will be considered further in the section on radiation.

Hare found that in the five living cases there has been no deleterious effects on growth, all the children having developed normally despite radical surgery and heavy doses of radiation. The cholesterol determinations have remained within normal limits and there have been no clinical symptoms suggestive of myxedema. On the contrary, in the adult cases about 15 per cent have developed a mild degree of myxedema.

In an interesting discussion of Hare's paper, Portmann criticizes the diagnosis in the cases reported by Hare and other cases in children reported as thyroid carcinoma. He raises the following points:

(1) They are usually described as originating in papillary cyst adenomas, aberrant thyroids or thyroglossal duct. All these terms, Portmann maintains, mean that the growths originated in derivatives of the pharyngeal pouch.

(2) Distant metastases did not develop in a single instance although many patients had what were looked upon as recurrences.

(3) Not one patient died prior to the reporting of the case in the literature, and some are still well after a number of years.

For these reasons Portmann questions the propriety of including these juvenile cases as malignant thyroid gland tumors *per se*, despite their similarity of histological appearance to adult malignant thyroid tissue. He claims that their morphology is essentially that of a papillary adenoma, that they may have a histological appearance which may be interpreted as malignancy but that they remain localized and do not destroy vital functions and, therefore, are not cancers of the thyroid.

Hare and Warren, however, feel definitely that this group of tumors in children are true malignancies of the thyroid which arose in the gland. Warren (8) remarks of the age distribution of the Lahey Clinic cases: "Increasing experience with thyroid malignancy has demonstrated to us the great fallacy of thinking that youthfulness of the patient precludes the presence of cancer of the thyroid." He and his co-workers point out that 16 per cent of their patients were less than 31 years of age and more than one-third were less than 41.

Sex Distribution.—This is a point of some speculative interest. Eberts (4) puts the sex ratio in his cases as 5.6 female to 1 male. From these figures is deduced the conclusion that carcinoma of the thyroid is relatively more prevalent in men than in women inasmuch as the sex ratio in nodular goiter is found by Eberts to be 9 to 1. Pemberton's figures are 1.77 to 1 for malignancies and 5 to 1 for nodular goiters.

On the other hand, Clute and Warren in analyzing the Lahey cases found an incidence in malignancies of 7 females to 1 male, which is the same sex ratio for all cases of goiter operated on. From this similarity they infer the common origin of cancer in previously diseased thyroid glands.

Hyperthyroidism and Cancer.—Pemberton found no constant change in the basal metabolism rate in cancer of the thyroid nor in any group of cancer of the thyroid. Dinsmore (12), in analyzing the previous history of malignancies, says that in approximately one-third of the cases patients will have some symptoms of over-activity of the gland.

Clute and Warren (8), in a discussion of this question, state that cancer may occur coincidentally with exophthalmic goiter. They believe that in these cases, of which they record four, the malignancy occurred in a coincident adenoma in the hyperplastic gland but that the hyperthyroidism was related only to the presence of hyperplasia in the otherwise normal tissue. They

have no evidence that hyperthyroidism arises as a result of the activity of the malignant thyroid tissue itself. There is evidence that some thyroid malignancies, however, have secretory power. They cite a case of Eiselsberg which developed hypothyroidism after excision of an adenomatous thyroid gland. The hypothyroidism was relieved after the development of a sternal nodule which proved to be metastatic adenocarcinoma of the thyroid. On removal of this nodule the patient again became a case of hypothyroidism.

Eberts quotes several authorities who support the view that hyperthyroidism may be the first sign of a malignant change in a benign goiter. He finds as yet no agreement on its frequency. Since the practice of determining the basal metabolism of all thyroid cases has become a routine, the percentage of malignant cases with hyperthyroidism has steadily risen.

Ewing is the authority most often quoted for the statement that the symptoms of Graves' disease may appear during the development of a malignant tumor and that the characteristic hyperplasia of Graves' disease may go on to malignant growth. Herbst (13) analyzed over 5,000 cases of exophthalmic goiter without meeting one case of malignant disease.

Clinical Diagnosis of Malignancies of the Thyroid.—Most modern writers emphasize the fact that the so-called classical symptoms of cancer of the thyroid are those of the end-stages of this condition. A committee on thyroid tumors of the California Medical Association issued, in 1934 (14), a report of recommendations on treatment. They state concerning clinical diagnosis made before operation that the more certainly cancer of the thyroid can be diagnosed, the more hopeless is the prognosis. Findings suggestive of malignancy, fixation of the tumor to the trachea and surrounding tissues, hoarseness arising from involvement of the recurrent laryngeal nerve, dysphagia, local or radiating pain, enlargement of the regional lymph glands, all are dependent on exten-

sion of the malignant tissue beyond the capsule. Other signs, which are not constant, are rapid increase in size and hard consistency on palpation—the latter without evidence of calcification on x-ray examination. From the difficulties of early clinical diagnosis and the further difficulties of accurate pathologic examination, it follows “that the problem is one of prophylaxis and prevention rather than diagnosis and cure.”

Almost all five-year cures are among patients whose first diagnosis of malignancy was made at the operating table or in the laboratory. The California report recommends operative treatment in all cases of nodular goiter in which—

- (1) Recent growth has taken place in a previously stationary gland;
- (2) Fixation of the goiter to the trachea or surrounding tissues has taken place;
- (3) Consistency of the goiter is hard and calcium deposits are not demonstrable by x-ray examination;
- (4) There is a history of pain, dysphagia, or respiratory difficulty in a previously symptomless goiter.

Clute and Warren give the following as the early significant and suggestive signs of thyroid malignancy:

- (1) The slow growth of an adenoma over a period of weeks and months;
- (2) Increasing firmness of the tumor and the occurrence of a sense of pressure in the neck, with lack of freedom of movement.

The Question of Operation for Benign Adenoma.—Pemberton states the generally accepted view that because of the definite risk of carcinoma and the low operative risk and morbidity and the small incidence of recurrence, operation should be at least advised in all tumors of the thyroid gland.

Crile and Portmann (12) state that it is a safe general rule for surgeons to consider as inoperable from the standpoint of curability those cases in which there are clinical evidences that the growth has extended through the capsule of the thyroid,

this invasion being manifested by fixation of the gland, by involvement of the lymph nodes, or by metastases.

Eberts quotes De Quervain as saying, “Cure rather than diagnosis should be the surgeon’s goal, and this can be obtained only if the operation is undertaken early and on no more substantial ground than suspicion. By far the greater number of cases reported as permanent cures are those in which malignancy was not even suspected when operation was performed, the clinical diagnosis being simple adenoma.”

Classification of Carcinoma of the Thyroid.—As the pathologic grouping of carcinoma of the thyroid is intimately bound up with the questions of radiosensitivity and prognosis, it is unfortunate that there should be such a bewildering array of classifications. Graham’s reasons for this confusion have been previously cited.

Haagenson (2) mentions the extreme morphological variation existing in these tumors and the great difficulty of differentiating between benign and malignant growth. He cites Wilson’s series of 97 clinically malignant cases of which 23 were passed as benign by pathologists. On the other hand, Graham reviewed in 1924 (3) some 108 cases which he formerly had designated as malignant. Applying his criterion of malignancy, blood vessel invasion, he found that 43 of these cases did not have evidence of malignancy.

The existence of “benign metastasizing goiter” has been denied by most of the later authors. Pemberton considers that this idea gave rise to confusion by putting carcinoma of the thyroid in a special category not shared by carcinomas elsewhere. Simpson (15) analyzed reported cases of metastases from apparently benign thyroid tumors. He maintains there is no such entity as the benign metastasizing goiter and shows that there exists in such cases undetected areas of adenomatous proliferation. Eberts mentions similar reports from European literature; notably Delannoy and Dhallium, who, from an analysis of 72 cases reported as benign

metastasizing goiter, concluded that few if any of the cases had been proved to be benign. Berard and Dunet maintain that even though not demonstrated, yet there must have been in these cases a primary lesion in the thyroid gland.

A potent source of confusion in terminology has been attempts to make classifications to suit various theories as to the etiology of these tumors. Haagenson concludes that our knowledge of the etiology of thyroid tumors is yet too meager to allow their classification according to their development from adult thyroid follicles, from fetal adenomas or otherwise. Ewing believes it more probable that many carcinomas arise from adult follicles, while Wolfler and Langhans assumed all the epithelial tumors of the thyroid to arise from fetal cell masses.

Another source of confusion is the question of the mesoblastic or epithelial origin of certain types of tumors. One of these is the small round-cell carcinoma (carcinoma simplex). Ewing, Haagenson, and Warren all deny the mesoblastic origin of these tumors. They are to be differentiated from lymphosarcomas (which they greatly resemble), because of the nature of the nuclei, their tendency to clumping of cells in certain areas, the nature of their metastases, and their response to radiation.

Another type of tumor about which there is dispute as to the exact nature of the tumor cell is the giant-cell carcinoma. Warren (8) says, "These tumors present bizarre pictures with almost every conceivable size and shape of cell, with marked variation of nuclear structure." Certain European authors dominated by theoretical considerations of the mesoblastic origin of large classes of thyroid tumors have confused the terminology. Berard and Dunet, for instance, include 17 different types originating from epithelium, connective tissue, and mixed tissue.

Ewing (16) believes that notwithstanding the wide acceptance of numerous reported cases of sarcoma, there is strong reason for believing that the great majority of these tumors are of epithelial origin.

Pemberton (1) states that although the incidence as reported in the literature is probably far too high, sarcoma nevertheless has been positively diagnosed at the Mayo Clinic in four instances in the course of pathologic examination of approximately 40,000 thyroid glands. All of the four patients died within a year of operation.

The pathological classification found adequate for the grouping of all cases of primary malignancy of the thyroid used at the Mayo Clinic (Pemberton) is very simple, with only five classifications:

- (1) Papillary Adenocarcinoma;
- (2) Adenocarcinoma in Fetal Adenoma (Malignant Adenoma);
- (3) Diffuse Adenocarcinoma;
- (4) Epithelioma;
- (5) Sarcoma.

This grouping has been adequate for all cases of primary malignancy of the thyroid gland.

The classification of Allen Graham, as used at the Crile Clinic, lists several subdivisions as varieties of sarcoma regarding which there is controversy, with the majority opinion leaning toward their epithelial origin. It is as follows:

- (1) Sarcomas
 - (a) Lymphosarcoma
 - (b) Spindle-cell Sarcoma
- (2) Mixed Tumors
 - (a) Carcinoma-sarcoma
- (3) Carcinomas

(a) Scirrhus Carcinoma	} not in Adeno-
(b) Adenocarcinoma	
(c) Papillary Carcinoma	} ma
(d) Malignant Adenoma	

At the thyroid clinic of the Montreal General Hospital, Eberts uses a classification containing subgroups of epitheliomas and endotheliomas.

At the New York Memorial Hospital, Ewing has tried to reduce classification to its simplest form by combining several closely related forms under one heading. Haagenson observes that our knowledge of etiology is yet too meager to permit of classification under the precursal cell forms. Their classes are as follows:

- (1) Papillary Cystadenocarcinoma (30 per cent);
- (2) Small Alveolar, Large-cell (Hürthle Cell) Carcinoma (6.6 per cent);
- (3) Adenocarcinoma (46.7 per cent);
- (4) Giant-cell Carcinoma (10 per cent);
- (5) Small Round-cell Carcinoma (6.6 per cent).

The Question of Radiosensitivity of Thyroid Tumors.—Haagenson (2) noted that in the Memorial Hospital series primary regression was obtained only in the first three of the above groups, never in the last two. He finds that the malignancy and anaplastic character of the tumors increase in the order of classification. Their radiosensitivity decreases as their anaplasia and rapidity of growth increase. The most rapidly growing and anaplastic types appear to be uniformly radioresistant. In an interesting discussion of hitherto proposed laws of radiosensitivity such as the law of Bergonié and Tribondeau and similar theoretical statements, Haagenson points out the unsatisfactory clinical applications in tumors of various regions. He finds that these proposed laws governing radiosensitivity fail because the phenomena involved are a great deal too complex to be envisaged by a simple statement of one or two factors, such as anaplasia, rapidity of cell division, etc. He proposes a scheme for the estimation of the radiosensitivity of tumors involving a study of the constitutional factors such as age, development, nutrition, hemic status, systemic disease; secondly, local factors—infection and blood supply; thirdly, the factors inherent in the tumor—rate of growth, morphological character, and anatomical situation.

The classification of thyroid malignancies developed by Shields Warren with Clute and Smith (7, 8, 9, 17) and used in the Lahey Clinic series is based on the relative radiosensitivity of definite histological types and appears to me to be the most useful in promoting co-operation between the surgeon and the radiologist. Thyroid cancer is divided into three main clinical divisions. In Group I is the pa-

tient with low or potential malignancy; in Group II we have the patient with definite but not hopeless malignancy, and in Group III we have the patient with severe and usually incurable malignancy.

Group I is divided pathologically into two classes:

(1) *Adenoma with Blood Vessel Invasion.*—This is the type of tumor in which Allen Graham made the important contribution of proposing blood vessel invasion as an index of malignancy. In 1,114 adenomas examined by Warren, 3.1 per cent showed varying degrees of invasion of blood vessels and 10 per cent of these patients died of metastases. Adenomas in which fully developed carcinoma is present are not included in this group. The adenoma is of usually undifferentiated type, either embryonal or fetal.

(2) *Papillary Adenocystomas.*—These tumors are regarded as malignant if they show evidence of capsule, blood vessel, or lymphatic involvement. Origin from aberrant thyroid tissue is not infrequent. This tumor has a characteristic histological appearance because of its tracery of branching papillæ. It is characteristically radiosensitive because of its papillary nature.

Warren states that both types of tumors in Group I are susceptible to x-ray treatment and that extension of the growth in many recurrent cases has been markedly slowed and limited by persistent x-ray treatment after operation.

Patients dying of cancer of the thyroid of the Group I types have been those with clinically obvious cancer which was far advanced at the time of the original operation. In none of the patients of this group which Clute and Warren followed, has any recurrence appeared when the patient was well to clinical and x-ray examination a year or more after the original removal of the thyroid tumor.

Group II: In this group are placed all cases of adenocarcinoma of the thyroid. There are wide morphological variations but the group may be divided histologically into two forms, the papillary adenocar-

cinoma and the non-papillary or alveolar. The papillary forms differ from the malignant papillary cystadenoma in their multiple epithelium and in the greater variability of their cells, both in size and shape. The evidence of invasion is much more frank.

The alveolar forms include several types which grade so imperceptibly from one to another that any separation into classes would be arbitrary.

Although adenocarcinoma of the thyroid is relatively slow growing, recurrences are frequent and there is a high mortality. Clute and Warren report that 54.8 per cent of the group of 31 patients which they followed have died, while another 14 per cent show evidence of recurrence.

X-ray treatment in this group is believed to have added to the length of life of patients who had recurrences. Inoperable tumors have become operable after intensive treatment.

Haagenson reported on cases corresponding to this group: a 71 per cent primary regression, with a mortality of 57 per cent.

Group III: In this group Warren and his associates place the most highly malignant tumors with hopeless prognosis. They subdivide the group into four classes:

- (1) Squamous-cell or epidermoid carcinoma;
- (2) Carcinoma simplex or small-cell carcinoma, which may be either compact or diffuse;
- (3) Giant-cell carcinoma, often called "carcinosarcoma";
- (4) Extremely rare fibrosarcoma.

As mentioned previously, there is dispute over the exact nature of the second and third classes, many of these cases being classified as sarcoma by other authors.

These tumors clinically are distinguished by their rapid growth with pressure symptoms. Clute and Warren in common with other authors emphasize the hopeless prognosis of these Group III growths. However, the recent report of Hare (18) gives grounds for believing that with the most modern methods of intensive therapy, types formerly considered radioresistant

may respond favorably. He reports great progress in the treatment of Group II and Group III tumors. He finds that the two varieties of small-cell carcinoma and giant-cell carcinoma decrease in size more rapidly than do the other types, but at the same time require a larger dose to prevent recurrence. He believes that the dosage delivered to the tumor bed by older methods of treatment has been insufficient. He finds that with modern shock-proof apparatus the use of a cone directly on the skin with no overlapping allows a larger dose to be given. He gives 1,500 r to each side of the neck through 80 sq. cm. portals, each area receiving six treatments of 250 r each. The dermatitis appearing in from 10 to 14 days clears in about three weeks' time. The reaction in the upper respiratory tract is not alarming with proper care. I feel that this routine could be improved by increasing the filtration from 0.5 mm. Cu to 2 mm. Cu, with an increase in the total dose. This would require more protracted treatment.

The recent rapid progress in radiation of these malignant types can be appreciated by contrasting this recent report of Hare with the 15-year-old report of Haagenson previously mentioned. In discussing the treatment of these cases, the latter says: "In anaplastic, rapidly growing fatal types, the giant-cell carcinoma and the small round-cell carcinoma, external radiation may be tried, but as no one has yet reported beneficial results it should not be given to the point of making the patient uncomfortable."

The papers of Portmann (12), Bowing (19), Pemberton and Fricke (20), Craver (21), and Haagenson (2) discuss the treatment of carcinoma of the thyroid of various types, giving criteria of operability and the further treatment of both operable and inoperable cases by radium and x-ray.

Bowing divides his cases into operable, borderline, inoperable, and recurrent. His radiotherapeutic program is formulated after consideration of clinical and surgical opinion, histopathology and extent of local and distant destruction or impairment.

The details of methods of radium therapy used at the Mayo Clinic are given by Pemberton and Fricke.

No pressure signs except a slight cough. She was recovering from an otitis media. The girl was nervous and depressed. She

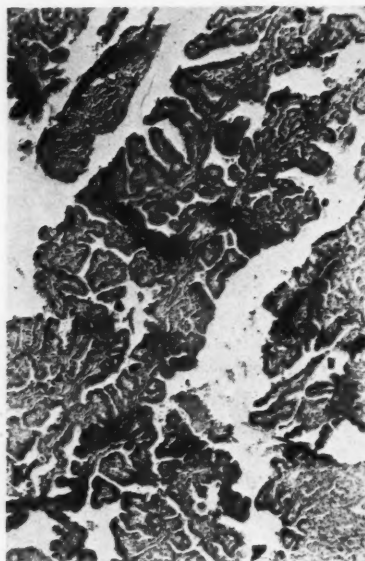


Fig. 1.

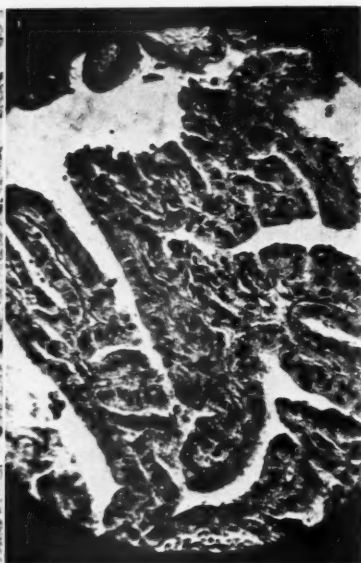


Fig. 2.

Figs. 1 and 2. Photomicrographs of sections of tissue from case reported.

All these papers emphasize the necessity for co-operation between the surgeon and the radiologist. It is recognized that surgery alone is not justified even if the growth is apparently entirely removed. Irradiation alone is a poor policy except in totally inoperable cases. Pemberton reports 10 per cent of cures in totally inoperable cases treated by radiation therapy alone.

CASE REPORT

A report of a case is appended, of interest because of the occurrence of carcinoma of the thyroid in the early age group.

E. G., white American girl of 15, normally developed, was admitted to the service of Dr. E. P. Fish at the Sisters' Hospital, Waterville, Maine, with a protuberant tumor over the thyroid region which she had noticed to be increasing in size for the past four years. The tumor was in the midline, moderately hard, not fixed.

had a tremor of the tongue and a basal metabolic rate of plus 46 per cent before operation.

The pre-operative diagnosis was fetal adenoma. Malignancy was not seriously considered before operation. At operation a large cystic adenoma was found, involving the isthmus and a large part of the right lobe. This was dissected as completely as possible, although the capsule could not be entirely freed posteriorly. A subtotal thyroidectomy was performed.

On section the tumor proved to be a definitely malignant papillary cystadenoma. The diagnosis was checked by Dr. Shields Warren and Dr. Howard Clute who assigned the tumor to Group I of their classification. The wound healed cleanly with an uneventful post-operative course and radiation therapy was started two weeks post-operatively.

X-ray examination of the neck and thorax showed no evidence of extension or

invasion of the tumor. X-ray treatments were given daily with oil-cooled type of shock-proof apparatus with 200 kv. p., 2 mm. of copper and 1 mm. of aluminum filtration, 15 ma., at 50 cm. focal-skin distance. The daily dose consisted of 200 r units delivered in 27 minutes to the right and left sides of the neck alternately through a 15 × 15 cm. square portal. This gave a dose of 1,500 r to each side. One week following her last treatment the patient returned to the hospital with restlessness, dysphagia, and a sense of fullness in the throat. She could take liquids only. The mucous-membrane reaction and skin reaction were very moderate. Apparently this dosage might have been considerably extended to the point of producing the extreme reaction of the Coutard technic but I thought it best to adhere to the dosage given by Hare. Evidently the reaction, using 2 mm. of copper filtration, was much milder than that described by Hare, using 0.5 mm. Cu.

The patient was in a restless condition during the period of reaction and her basal metabolic rate was plus 49 per cent. After a week's rest she was comfortable and her metabolism had dropped to minus 11 per cent. It is now six months since her operation. Her basal metabolism rate is still minus 11 per cent. Her weight has increased 26 pounds and her height one inch. She suffered from a psychic depression post-operatively and left school because of the fancied hopelessness of her condition. She seems to be getting over this stage now. Clinically she is in the best of health, with no such evidence of thyroid deprivation as would require substitution therapy. There is no evidence of recurrence to date.

SUMMARY AND CONCLUSIONS

A survey of the recent literature from several of the largest American thyroid centers has been made in regard to the incidence, diagnosis, histopathology, and treatment of carcinoma of the thyroid. A comparison of pathologic classifications in use, with especial attention to the

question of radiosensitivity, leads to the conclusion that statistical study and treatment could be advanced by the adoption of a standard classification of the type formulated by Warren and his associates. The question of juvenile malignancies of the thyroid has been considered and a case of malignancy in an adolescent reported. The conclusion is derived that the most modern methods of protracted radiation therapy have apparently yielded better results than older methods in cases considered intractable to treatment.

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THE TRANSMISSION OF AN INVISIBLE RADIATION THROUGH VARIOUS CHEMICAL SOLUTIONS AS RECORDED BY THE INFRA-RED PLATE

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THE probable value of infra-red photography to the radiologist prompts this further study of the physical properties of the infra-red radiation. In previous reports in *RADIOLOGY* by the author (5 and 7), the methods of simultaneous infra-red roentgen photography and photographic images obtained in total darkness by both penetration and reflection are described.

The purposes of this study are to demonstrate first, the properties of penetration through various colored chemical solutions by an invisible radiation from a source of ordinary light and, second, the absorption or "stopper" action of the various salts of copper.

In order to clarify to some degree the experimental evidence under discussion, it seems that a few remarks on the general physics involved in this problem might be of interest to the reader. According to accepted theories on the constitution of matter, it is assumed that all matter is made up of a very large number of infinitely small particles or molecules. The molecules are more or less independent of one another when the matter is in the gaseous state, but in the liquid and the solid states of matter they lose some part of their independent character. The molecules are also supposed to be subdivisible into atoms. These atoms and molecules, or some portions of them, are also supposed to be in a violent state of vibration, oscillation, or agitation, which is associated with what we call heat and light.

These radiations, however, only become evident to our senses when the waves impinge on sympathetic particles or molecules of matter. That is, if the molecules are so constituted that they, or some portion of them, respond to the impinging waves, the waves are extinguished and vi-

bration induced. In other words, if the natural period of vibration or motion of the molecules is "in tune" with the impinging

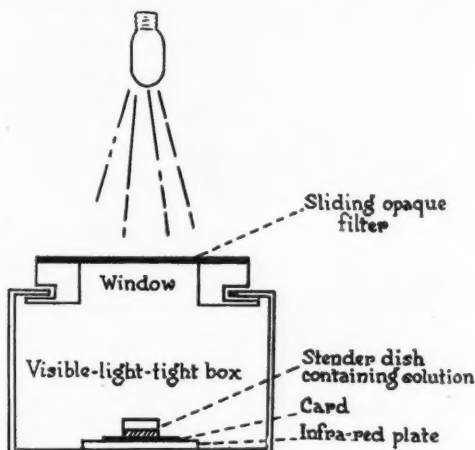


Fig. 1. Diagram of photographic apparatus.

waves, vibration is induced. Otherwise the waves pass on or are reflected, apparently having no effect on the molecules.

The wave theory of light assumes that the disturbance known as light consists of a wave motion in a medium known as the ether. In the ether of space, waves of all lengths travel with the same velocity.

In 1850, Foucault (8) demonstrated very definitely that the velocity of light in water is less than in air, though he made no estimate of the ratio. Michelson, however, measured the relative velocity of light in air and water and found the ratio to be 1.33:1. Michelson (8) has also shown by direct measurement that the velocity of red light is 1.4 per cent greater than that of blue light. Dispersion is therefore due to the unequal retardation in the speed of transmission of the different colors through transparent media. The violet rays, which are the shortest waves in the visible spec-

trum, suffer the greatest retardation, or travel more slowly than red, when they enter an optically denser medium. Physi-



Fig. 2. Ordinary photograph taken with reflected light of a card and a Stender glass dish containing 20 c.c. of azo-fuchsin. Illumination from a 500 watt tungsten bulb. Eastman portrait film. Exposure time 4 seconds at f. 22. Contact print.

cally the differences in spectral colors are differences of wave length, the short waves suffering greater diminution of velocity in a dense transparent body than the long waves. Hence the ratio of the velocity of light in air to its velocity in a second medium is called the *Index of Refraction* of the second medium, as referred to air.

Materials and Methods.—The box shown in the diagram (Fig. 1) is constructed of wood and lined with lead. The filter which closes over the window in this box is a photographic film holder slide which serves as a protective measure when using ordinary emulsions. Hence all visible light is prevented from entering the inside of the box. This slide, however, becomes very transparent when used in conjunction with the infra-red emulsion, for even the invisible emanations from subdued visible light will cause fogging of the plate. An Eastman infra-red plate, type 1R, is placed in the bottom of the box with the emulsion side directed upward. A card having

printed matter on both of its sides is laid on the plate in contact with the emulsion. This card is used in this way to demonstrate the penetrating effect of the invisible radiation entering the visible-light-tight box. A Stender preparation dish containing 20 c.c. of a 1 per cent aqueous solution of the chemicals listed in Tables I, II, and III is placed on the card. Figure 2 is a contact print of an ordinary photograph taken with reflected visible light, showing the arrangement of the photographic plate, the card and the dish containing the solution, as it is placed inside the light-tight box. The printed matter on only one side of the card is recorded in this ordinary photograph. The window is then closed by the sliding filter and the box exposed to the illumination from a 500 watt tungsten bulb with the illumination directed over the closed window for four seconds (Fig. 1). The invisible rays emanating from the tungsten lamp penetrate this opaque sliding filter and activate the emulsion of the infra-red plate inside the box. The plate is then developed and handled in total darkness. Figures 3, 4, 5, and 6 are contact prints from negatives which have been activated by this invisible radiation. The author has discussed various applications and methods of infra-red photography in previous publications (1, 2, 3, 4, 5, 6, and 7).

All of the photographs presented in this report are contact prints.

Observations.—Figure 3 is a contact print illustrating the photographic effect obtained with each solution which transmits the radiation entering the box. It is to be observed that this radiation must pass through the color dye and through the bottom of the glass dish before reaching the emulsion. Clear glass is supposedly as opaque to radiation from a non-luminous source as black glass is to visual radiation. In spite of this apparent obstruction, the radiation is recorded on the emulsion of the plate covered by the dish before it is recorded on the surrounding unobstructed area. It is obvious, therefore, that this radiation is passing through each of these

solutions with greater velocity than through the surrounding air. In Figure 3 the white circular area, which is the area covered by the dish and its contents, reveals this effect rather vividly. The printed matter on both sides of the card is also plainly visible.

The color dyes listed in Table I range from red to violet. In each case the dish, containing 20 c.c. of a 1 per cent aqueous solution of the dye, is placed inside the box in the same manner as mentioned above.

TABLE I.—COLOR DYES IN SOLUTION

1% Azo Fuchsin.....	Transparent
1% Carmine.....	Transparent
1% Rhodamine.....	Transparent
1% Fast Light Orange.....	Transparent
1% Thioflavine.....	Transparent
1% Neptune Green.....	Transparent
1% Methylene Blue.....	Transparent
1% Victoria Blue.....	Transparent
1% Methyl Violet.....	Transparent

The photographic effect obtained with each of the color solutions shows no variation in the degree of transmission of this invisible radiation. All of the dyes transmit the radiation with the same velocity. The same dyes in solution are then interposed between the source of visible light and the box. The use of these color solutions in this manner obviously changes the wave length of the radiation striking the filter in the window of the box. The box is then exposed to the same intensity of light for four seconds, the same exposure time as is used in the previous experiment. Again there is no variation in the transmissibility of the solutions inside the box. Hence, the changing of the wave length of the visible light source from the violet (3,800 Å.) to the red (7,800 Å.) does not alter the effect

TABLE II.—METALLIC SALTS IN SOLUTION

1% Copper Sulphate.....	Opaque
1% Copper Chloride.....	Opaque
1% Copper Acetate.....	Opaque
Benedict's Solution.....	Opaque
1% Gold Chloride.....	Transparent
1% Lead Acetate.....	Transparent
1% Lead Acetate (stained blue)....	Transparent
1% Silver Nitrate.....	Transparent
1% Nickel Sulphate.....	Transparent
1% Chromic Acid.....	Transparent
1% Zinc Acetate.....	Transparent



Fig. 3 (above). Infra-red photograph taken in total darkness. A card, having printed matter on both of its sides, and a Stender dish containing 20 c.c. of any of the solutions listed in Tables I-III, with the exception of the copper solution, are placed on an infra-red plate inside the visible-light-tight box. The box is then exposed to the illumination from a 500 watt tungsten bulb for 4 seconds. Contact print.

Fig. 4 (below). Infra-red photograph taken in total darkness. A card having printed matter on both of its sides and a Stender dish containing 20 c.c. of a copper solution are placed inside the visible-light-tight box and photographed with the same technic as is used in Figure 3. Contact print.

of the photographic image obtained inside the box.

The tabulation of the photographic results obtained with various metallic salts in solution (Table II) reveals that thus far copper is the only metal in solution which acts as a "stopper" of this invisible radiation. There is no activation of the emulsion of the infra-red plate in the circular area covered by the dish containing the copper solution (Fig. 4). All of the other



Fig. 5 (above). Infra-red photograph of pieces of solid glass rod. The same photographic technic is used as in Figures 3 and 4.

Fig. 6 (below). Infra-red photograph of glass beads. The same photographic technic is used as in Figures 3 and 4.

metallic solutions listed in Table II are very transparent and show no variation in the degree of transmission. In view of these observations it seems logical to conclude that this radiation must be confined to a rather limited region in the infra-red band. Landauer (9) states that the absorption spectra of copper solutions are not very characteristic because almost all of them are two-sided, that is, there is absorption in both the violet and red ends of the spectrum. This observation is interesting, for we know that the infra-red plate is also sensitive in both the violet and red ends of the spectrum. Thus it would seem that there is possibly a definite relationship between the facts that the absorption spectra

of copper and the sensitivity of the infra-red plate are in the same regions of the spectrum.

TABLE III.—MISCELLANEOUS CHEMICAL SOLUTIONS

1% Sodium Iodide.....	Transparent
1% Sodium Bromide.....	Transparent
1% Sodium Chloride.....	Transparent
1% Alum.....	Transparent
1% Sucrose.....	Transparent
Tap Water.....	Transparent
Boiled Water.....	Transparent
Hydrogen Peroxide.....	Transparent
Alcohol.....	Transparent
1% Sodium Carbonate.....	Transparent
1% Potassium Permanganate.....	Transparent
1% Quinine Bisulphate.....	Transparent

Table III is a tabulation of the results obtained with miscellaneous chemical solutions. It is noted that sodium iodide and sodium bromide, which are opaque to the roentgen ray, transmit the radiation entering the box readily. The solutions of alum and sucrose which supposedly absorb about 88 per cent of the non-luminous radiations from a source of light, are also transparent to the invisible radiation entering the box.

The photographic effect of the refraction of pieces of solid glass rod and glass beads is shown in Figures 5 and 6.

The author gratefully acknowledges the aid of Mr. Charles R. Neterval, of the Department of Biochemistry, in the preparation of the chemical solutions.

SUMMARY

1. An invisible radiation having properties of penetration is obtained from an ordinary light source, and seemingly is transmitted through various chemical solutions with greater velocity than through air.

2. The filtering out of various regions of the visible spectrum in the visible light source does not alter the photographic effect obtained inside a visible light-tight box.

3. A 1 per cent solution of copper sulphate, copper acetate, or copper chloride

acts as a "stopper" of this transmission phenomenon. Copper in solution is the only "stopper" of this radiation which has thus far been found.

4. Atomic weight and density of the molecules in a solution, apparently have no effect on the transmission of this invisible radiation.

5. The results of the experimental evidence presented would indicate that this radiation is confined to a rather narrow band in the infra-red region.

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MEDIASTINAL HERNIA

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THERE has been little in the American literature of the past few years on the origin and development of mediastinal hernia or pneumatocele. During this time, however, the Italian and French schools have devoted considerable attention to this subject. Besta (1) has recently published a comprehensive review of the Continental literature with considerable original data, but there is little available in English. I, therefore, have thought that it would be of some interest to review the origin of this condition, and to consider the mechanism of its development, presenting several cases illustrating the various types.

First, just what do we mean by the term *mediastinal hernia*? It can be defined as the projection through the mediastinum of one pleural space into the other hemithorax. It was only with the development of artificial pneumothorax therapy coupled with the greater use of the x-ray both for fluoroscopy and plate work, that the possibility of such a condition was appreciated. Artificial pneumothorax is still the most common cause of hernia of the mediastinum, although it does occur in spontaneous pneumothorax and, as we shall see, occasionally in the absence of pneumothorax. The walls of the hernial sack as it protrudes through the mediastinum are formed by the parietal pleura lining each hemithorax. This is seen as a thin line on the film or the fluoroscopic screen, protruding into the normal lung-field.

Second, just where does this hernia through the mediastinum occur? Anatomically there are two so-called "weak spots in the mediastinum." The first

and the most important of these lies behind the sternum above and in front of the heart at the site of the atrophied thymus. The second lies below and posteriorly and is a space bounded below by the crura of the diaphragm, posteriorly by the spinal column, and in front by the esophagus as it bends forward to pass through the diaphragm. Once a small wedge has been driven through one of these spaces, however, the margins may be spread until the hernia occupies an area far greater than the original "weak spot."

Third, how does such a herniation of the mediastinum come about? What are the physical factors that lead to its development? It takes but little consideration to realize that the force that causes the hernia is a difference in pressure in the two halves of the thoracic cage and that this difference in pressure is the result of a difference in volume. It is also quite obvious that the mediastinum itself must be considerably more rigid than the "weak spot" otherwise the mediastinum as a whole would be shifted toward the hemithorax with the lowest pressure. It is also evident that if volume plays any part in the development of this condition then there must be a change in the size of the herniation during the different phases of respiration dependent on the changes in the size of the thorax as a whole. Also it is evident that a difference in pressure on the two sides of the mediastinum can be brought about in either of two ways: either the pressure on one side can be raised above the normal or mean, or the pressure on the other side can be lowered below that mean. We thus have either a pulsion or a traction hernia, depending

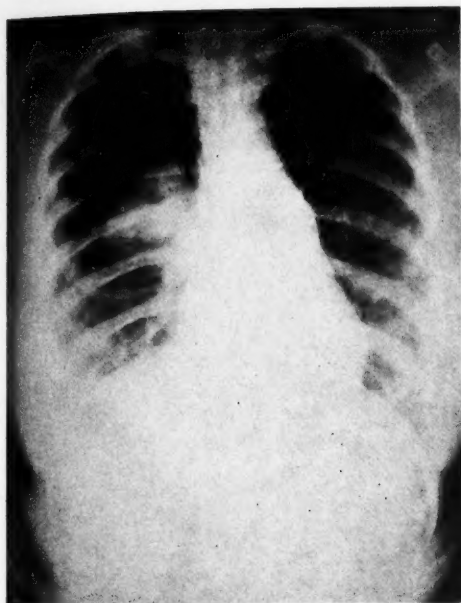


Fig. 1.

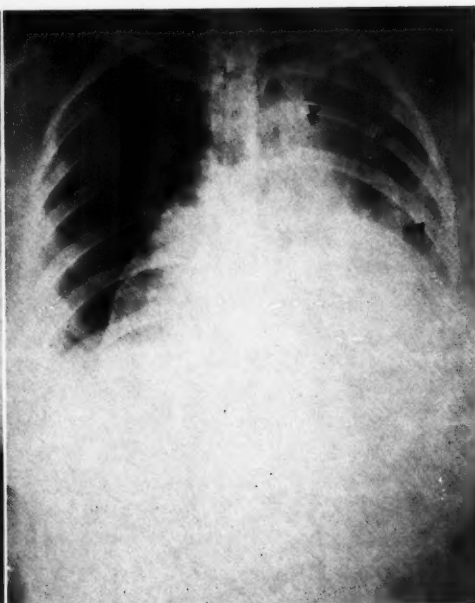


Fig. 2.

Fig. 1. Inspiratory phase of case of mediastinal hernia due to artificial pneumothorax.

Fig. 2. Expiratory phase, same case. Note greater prominence of hernia, showing it to be a pulsion type.

on which side of the mediastinum the force causing the hernia is applied.

The practical application of these physical forces is of considerable interest to us and deserves a few words. Let us take first the most usual mechanism as seen in mediastinal hernia resulting from artificial pneumothorax. In this case the air introduced into the pleural space is trapped there and is not in direct communication with the outside atmosphere through the trachea. During inspiration this air occupies a smaller percentage of the total volume of the hemithorax in which it lies than it does during expiration. Therefore, this trapped air when its volume is greatest during expiration, raises the pressure in the hemithorax above that of the other side, and a push is exerted against the mediastinum. If the mediastinum is labile, this push shifts it *in toto* toward the opposite side; if the entire mediastinum is rigid, then there is no shift; if, however, the "weak spot" is less resistant

to pressure than the mediastinum as a whole then we will have the development of a mediastinal hernia. If such a case is observed at the fluoroscope or films are made at the end of inspiration and of expiration, it will be seen that the line marking the limits of the hernia moves during respiration and bulges farthest into the contralateral hemithorax during expiration.

This situation is seen in Figures 1 and 2 which are films taken in inspiration and expiration, respectively, of a case of mediastinal hernia due to artificial pneumothorax. The intrapleural pressures on the right at the time these films were taken are as follows: On quiet respiration from 0 to -4 cm. of water; on deep inspiration -14 cm. and on forced expiration +5 cm. We see in this case that during inspiration the air trapped in the right pleura occupies the smallest percentage of the total volume of the hemithorax and the intrapleural pressure is most negative; the line limiting

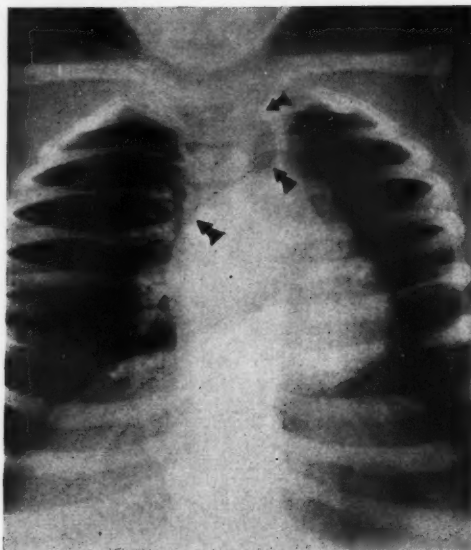


Fig. 3.

Fig. 3. Inspiratory phase of traction type of hernia. Note degree of herniation.

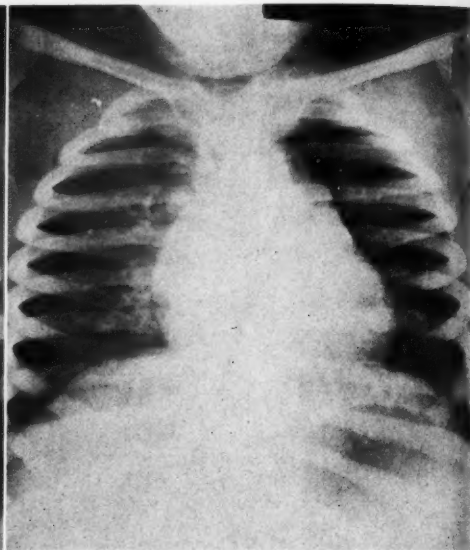


Fig. 4.

Fig. 4. Expiratory phase: note disappearance of hernia.

the herniation lies against or is lost in the shadow of the mediastinum. During expiration this line moves away from the mediastinum into the contralateral lung-field and the intrapleural pressure becomes more positive. This may occur even while the intrapleural pressure is negative during quiet respiration because the damage has been done by the high positive pressure developed during cough. In this sort of case, then, the bulging is most apparent during expiration, and we are dealing with the pulsion type of mediastinal hernia.

The traction type of hernia is much less common. Here the force causing the herniation is due to a loss of volume of one lung and a great increase in the negative pressure in that hemithorax so that the lung from the normal hemithorax is drawn through the mediastinal "weak spot." This loss of volume is usually the result either of fibrosis or atelectasis in the involved hemithorax. Figures 3 and 4 are films taken in inspiration and expiration of a patient showing this type of mediastinal hernia. This case is extremely interest-

ing from several angles. In the first place it is the only case of hernia of the mediastinum in the absence of pneumothorax that I have seen personally. In the second place, it was the confusion of ideas arising from the original x-ray report that stimulated my interest in this subject.

The story, in brief, is as follows. The child was admitted to the hospital after an illness of two days, with cough and fever. The resident made a diagnosis of pneumonia or bronchial obstruction of the left lower lobe. The chief on the service made a diagnosis of bronchopneumonia. The Mantoux test was strongly positive. The x-ray report on these films was as follows:

"Inspiratory phase of respiration demonstrated marked shift of the heart and mediastinum to the left, with herniation of the right lung through the mediastinum. During the expiratory phase the right lung returns to its normal position. Fluoroscopically it was noted that during the expiratory phase the left lung remained aerated and the heart shifted back to its normal position. This pathological physiology is indicative of an obstructive emphysema in the left main stem bronchus of long stand-

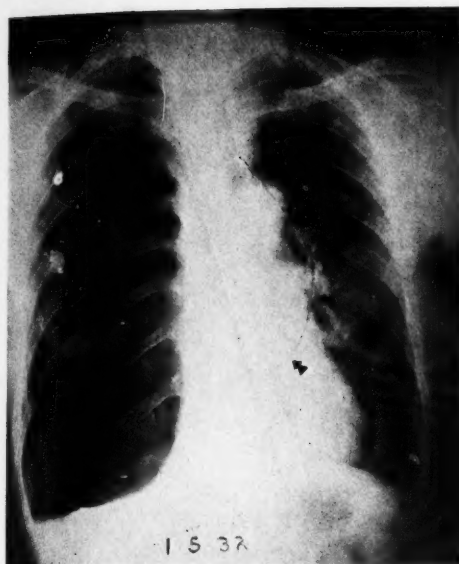


Fig. 5.

Fig. 5. Pulsion hernia due to spontaneous high pressure pneumothorax.

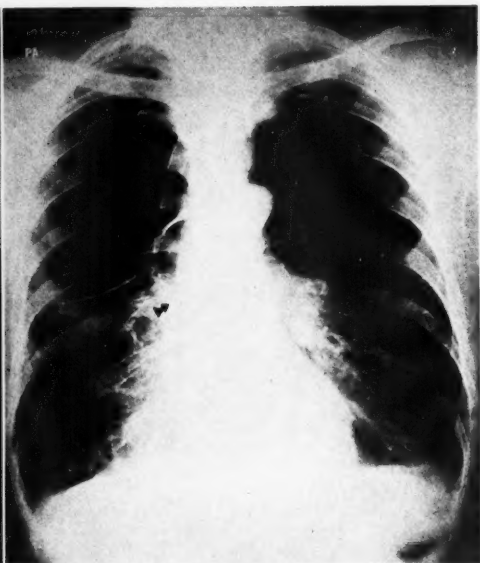


Fig. 6.

Fig. 6. Traction hernia in same case after closure of pleural tear and partial absorption of air.

ing, as we usually do not see herniation of the opposite lung through the mediastinum in this condition. Conclusion: obstructive emphysema of the left lung with herniation of the right lung through the mediastinum."

When I saw the child in consultation my findings were: "An atelectatic condition of the left lower lobe. This may be the result of obstruction in the left lower lobe bronchus. There is a slight compensatory emphysema in the left upper lobe. I do not believe there is any obstruction in the left main stem bronchus or any obstructive emphysema in the left lung. There is a possibility that the obstruction of the left lower lobe may be the result of the pressure by a tuberculous mediastinal gland."

The reason for these conclusions was chiefly that it is impossible to get a traction type of mediastinal hernia from an obstructive emphysema in cases in which the lung is over-distended. Also we had clinical evidence of atelectasis in the left lower lobe. Overholt (2) has pointed out that when atelectatic, the left lower lobe may be entirely hidden by the heart, the

only clue being a compensatory emphysema of the upper lobe. That is what we have here, I believe, only the compensatory emphysema was not sufficient to restore all the loss of volume; therefore, part of the right lung was drawn through the mediastinum.

Bronchoscopy was done in this case, and the report was "Purulent tracheobronchitis with considerable edema and swelling of the mucous membrane of the left bronchus." Following this bronchoscopy the fever abated, physical signs disappeared, and another x-ray examination four days later showed disappearance of the hernia and a normal left lung.

These two cases illustrate the pulsion and traction type of mediastinal hernia through the anterior "weak spot." The following cases show the practical value of differentiating these two types of hernia.

Figure 5 is a film of a man with a high pressure pneumothorax on the right side. At this time the intrapleural pressure on the right side was $0 + 10$ cm. of water, and we recognize a large pulsion hernia of the right pleural sack into the left hemitho-

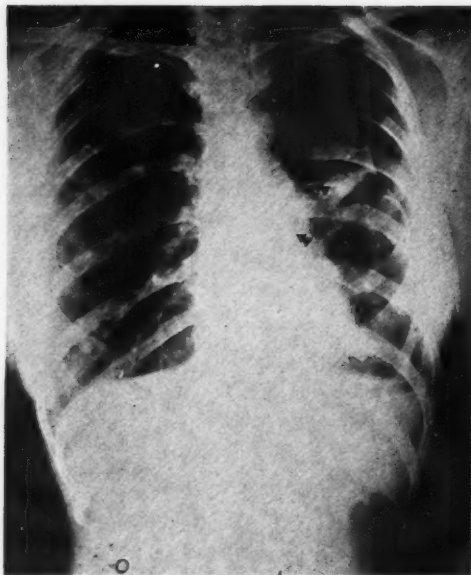


Fig. 7.

Fig. 7. Inspiratory phase showing mediastinal hernia in case of bilateral pneumothorax. Note greater prominence of hernia.



Fig. 8.

Fig. 8. Expiratory phase, same case.

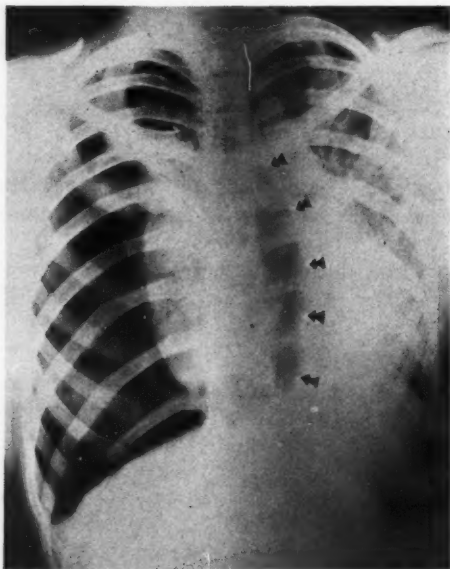


Fig. 9. Expiratory phase of hernia through lower posterior "weak spot."

rax. Subsequently, the pleural rent became sealed off and partial absorption of

the air occurred, but a small pneumothorax remained. We now see (Fig. 6) that the situation has changed and, instead of the former pulsion hernia, we have a traction hernia. The intrapleural pressure on the right at this time was -6-12 cm. of water. This case demonstrates that the process is reversible and that the direction of the herniation depends on the difference in the intrapleural pressure on the two sides of the mediastinum. The hernia always points toward the side with the lower pressure.

Figures 7 and 8 are from a case of bilateral pneumothorax in which there is a mediastinal hernia. The question arises here as to whether this is due to too much air on the right side or too little air on the left side. By studying these films, taken in inspiration and expiration, we see that the hernia is larger during inspiration and, therefore, we are dealing with a traction hernia from too little air on the left side. The intrapleural pressures confirm this, that on the right being -3-8 cm. of water and on the left -5-11 cm.

All these cases have been of herniation through the anterior "weak spot." Figure 9 shows the expiratory phase of a case with artificial pneumothorax and herniation through the lower posterior "weak spot." Here we see that the position of the herniation differs from that seen in the previous cases, a fact much more easily appreciated on fluoroscopic examination. Herniation of this type, in the presence of massive pleural effusion, is the probable explanation of the contralateral paravertebral triangular area of impaired resonance known as Grocco's sign.

SUMMARY

Attention is called to the fact that mediastinal hernia occurs through one of two "weak spots" in the mediastinum, as the

result of differences in intrathoracic pressure in the two hemithoraces, due to difference in volume.

That the degree of herniation varies with respiration and, therefore, must be studied in inspiration and expiration.

That there are two types of herniation. First, a pulsion type in which the hernia is more prominent in expiration. Second, a traction type in which the hernia is more prominent during inspiration.

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TWO UNUSUAL CASES OF EMPYEMA WITH SPONTANEOUS DRAINAGE

By LT. COL. ALBERT BOWEN, M.C., *Ft. Sam Houston, Texas*

ENCAPSULATED suppurative pleurisy presents many interesting diagnostic problems to both clinicians and radiographers. Two such cases have recently stimulated a study of this condition. One was mediastinal, the other interlobar. Both ruptured into a bronchus and both patients made excellent recoveries.

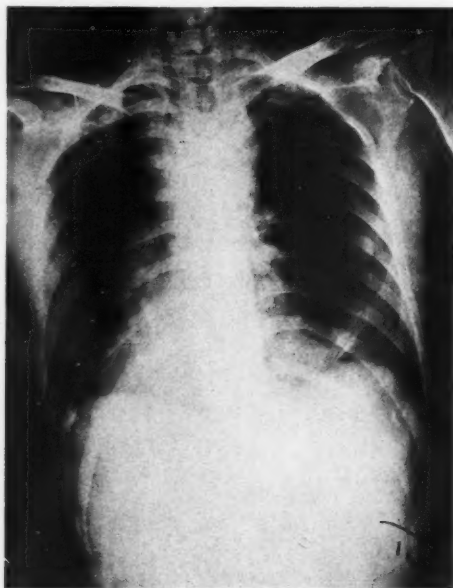


Fig. 1. Mediastinal abscess following perforation of esophagus.

Mediastinal empyema is in reality a suppurative pleurisy localized between the mediastinal and visceral layers of the pleura. It is also referred to as "mesial empyema." It may occur on either side of the mediastinum and is localized posteriorly more often than anteriorly. Wessler and Jaches (1), in their classic book, describe the condition as follows:

"A collection of fluid between the mediastinum and the lung is undoubtedly the rarest

of all effusions. Its development presupposes a fixation of the anterior or posterior margin of the lung, by which the fluid is retained in the mediastinal recess and is prevented from communicating with the general pleural cavity. Owing to the limited respiratory movement of this part of the chest, adhesions often wall it off from the lateral half of the pleural cavity. A mesial empyema may be primary, in addition to a lateral empyema, or develop after a surgical drainage of an ordinary type, due to infection of a previously uninfected mesial area. The proximity of these effusions to the heart may make them appear to be a part of it and the distinction between them and a pericardial effusion may be impossible."

Suppurative mediastinitis, or true mediastinal abscess, is a more rare and usually a fatal complication of some surgical condition—as a penetrating wound or esophageal perforation. Such an abscess is shown in Figure 1. Wessler and Jaches (p. 401) report a case of abscess in the right lower posterior mediastinum following lobar pneumonia which did not involve the pleura and which on the film could not be distinguished from a mesial effusion.

Snure (2) reviews the literature of mediastinal pleurisy and gives his findings in three cases. He says:

"While mediastinal pleurisy is not a frequent lesion, it is probably more often overlooked or incorrectly diagnosed than any other pleural condition. Unless an x-ray examination is made, it is not often diagnosed until rupture into a bronchus or other organ of the chest occurs. It would seem that pure pneumococcus type of effusion is about the only form that can rupture into a bronchus and the patient survive. Rupture usually takes place within a twenty-day period."

Sante (3) says:

"Effusions entrapped between the mediastinal pleura and the medial border of the lung are very rare, and we have never seen one which was localized close to this area that required operative procedure for evacuation."

He illustrates a case of a left mesial effusion with spontaneous rupture, showing a fluid level in the sac alongside and behind the heart shadow.

It is evident from the above references that mesial empyema is often a clinical problem and sometimes presents considerable difficulty in diagnosis. It is often overlooked. It follows or is concurrent with lobar pneumonia, and usually presents the classical signs of pus.

The mediastinal dullness to percussion is widened if the effusion is large enough. X-ray examination is the greatest diagnostic aid. Beside films in the usual position, fluoroscopic examination, and films in lateral and oblique positions, may be of value. Occasionally the Bucky diaphragm technic may be used in an effort to differentiate various densities.

Mediastinal and bronchial tumors sometimes cast a shadow similar to mesial effusion, but the clinical history and course should suggest inflammatory lesions when present.

The proximity of these effusions to the heart may make them appear to be part of it and the distinction between them and a pericardial effusion may be impossible. The shadow of pericarditis is homogeneous, while often the adjoining effusion is of a different density and a double heart shadow is made out.

A tuberculous spinal abscess may cast a fusiform shadow behind or to the right of the heart, but examination of the vertebral shadows should show its true nature.

CASE REPORTS

The patient, J. M., a soldier, age 55, weight 160 pounds, became ill on July 28, with a chill followed by a temperature of 103 degrees Fahrenheit. He had severe pain in the right chest and blood-streaked sputum. He was admitted to the hospital on July 29. The pleural pain was so severe that morphine was required.

Physical examination revealed signs of pneumonic consolidation in the right lower lobe. Roentgen examination showed the

right diaphragm obscured by an irregular area of consolidation, with definite thickening of the pleura along the axillary border. The trachea was in the midline and the heart moderately large. The left lung was clear.

July 31: Blood and sputum cultures were positive for Type II pneumococcus, and 50,000 units of Felton's antipneumococcus serum, Types I and II, were given during 48 hours, with marked clinical improvement.

August 1: In spite of his good clinical condition, examination showed a large area of consolidation in the left lung, apparently an extension. His temperature went up to 104° F. A bedside film showed the trachea, heart, and mediastinum markedly displaced to the left. The intercostal spaces were retracted but the diaphragm was not elevated. The lung was opaque and the picture rather typical of massive atelectasis. The right base showed considerable resolution, and the diaphragm was no longer obscured.

August 6: The temperature dropped by lysis and reached normal August 6. The patient's general condition was quite satisfactory. A film showed further clearing of the right lung. The left lung had the appearance of resolving pneumonia. The heart and mediastinum were still displaced to the left.

August 10: Though feeling quite well, the patient began to run daily evening temperatures of 100-101° F. A film showed the right lung clear, and the left lung showed further expansion and resolution, but the heart and mediastinum were definitely displaced to the left.

August 15: The evening temperature was running a little higher and the leukocyte count around 15,000. A film showed further clearing of the left lung, the heart much displaced to the left, the mediastinal shadow markedly widened on the right, suggesting encapsulated fluid.

August 21: The patient was feeling better and the general condition was good. Percussion dullness in the mid-chest extended 2.5 cm. to the right of the sternum.



Fig. 2. Case 1. Lateral film (retouched) showing extent of anterior mediastinal empyema.

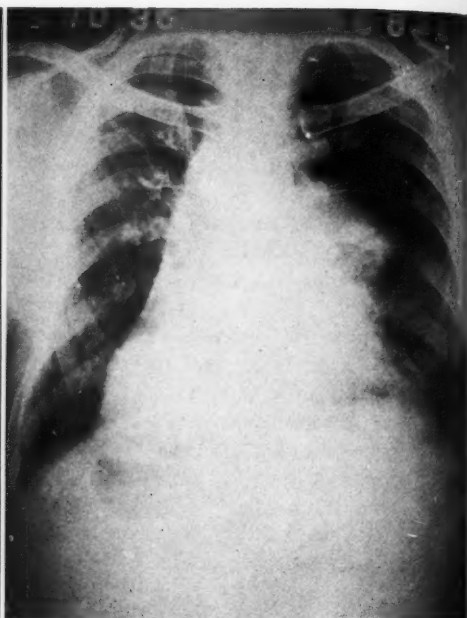


Fig. 3. Case 1. Five days after rupture of mediastinal empyema. Lower portion still very prominent.

The veins on the chest were enlarged. Radioscopic examination showed a non-pulsating oval mass to the right of and not connected with the heart. Films showed considerable inflammatory reaction in the lung parenchyma at the periphery of the mass. The impression was mediastinal empyema.

August 27: The patient remained in good condition. A film showed the heart displaced to the left by a rounded mass extending from the right hilus to the diaphragm, which could not be distinguished from the heart shadow.

August 30: The patient appeared to be improving clinically, having no pain or difficulty in breathing. The percussion dullness was 11 cm. to the left of the mid-sternum and 6 cm. to the right. Roentgenological report: The mass is larger. Lateral film shows a hemielliptical shadow in the anterior mediastinum extending upward 15 cm. from the diaphragm and 4.5 cm. centrally behind the sternum. This overlies the anterior part of the heart

shadow. Impression: anterior mesial empyema (Fig. 2).

September 4: Films showed an additional rounded shadow in the cardiohepatic angle.

September 5: At 5 P.M. the patient began to raise large quantities of foul sputum and filled six sputum cups during the night. The following day he raised only 60 c.c. He continued to show marked clinical improvement.

September 8: Films showed marked decrease in the size of the shadow at the right hilus with definite return of the heart toward the normal position. The lower rounded shadow near the diaphragm was more prominent. The patient showed exacerbations of fever from time to time coincident with his failure to evacuate the sputum from his cavity. This was definitely helped by postural drainage (Fig. 3).

October 5: The mediastinal shadow was much smaller and in nearly normal position. The heart shadow was smaller and

showed little displacement. The rounded mass in the cardiohepatic angle was markedly decreased in size and the parenchymal perifocal reaction largely absorbed. On the lateral film the shadows behind the sternum had shrunk to an irregular narrow mass (Fig. 4).

November 9: The lungs were clear except for some residual thickening of trunks and pleura and the patient was clinically well.

Comment.—The early displacement of the heart toward the left due to atelectasis of the left lung added to the difficulty of an early diagnosis of encapsulated fluid at the right of the heart. The mesial pleural area was probably walled off by the early pleurisy. At no time was the "double heart shadow" distinguished. Pericarditis with effusion was considered because of the tremendous apparent heart shadow. On the other hand, the danger of infecting the pericardium was a deterring factor in exploratory puncture. The excellent condition of the patient, together with absence of all pressure symptoms, led to postponement of surgical intervention, and while the surgeons delayed the patient very successfully drained himself spontaneously, on the thirty-ninth day after onset of the pneumonia. One wonders whether the large amount of anti-pneumococcus serum might not have been a factor in bolstering the patient's resistance to the large and prolonged empyema from which he suffered.

The second case is one of large interlobar effusion. In 1923 Wessler and Jaches (p. 352) said, "Interlobar effusions are as rare as they are difficult to diagnose by the usual clinical means." The progress in the study of this condition is well shown by Levitin and Brunn in a scholarly and exhaustive article in *RADIOLOGY*, December, 1935 (4).

Interlobar effusions and pus pockets are not uncommon and often are demonstrated on chest films as shadows of varying width along the interlobar lines. They are usually small and are easily



Fig. 4. Case 1. One month after rupture. Collapsed pus pocket retouched.

recognized in lateral films if not clearly demonstrated in the usual position. The shadows tend to remain central. Of large interlobar effusions, not much is reported. Wessler and Jaches (p. 362) show one case in which the effusion appears as a large cystic shadow obscuring nearly the whole lung but showing rounded margins and clear lung surrounding it.

Interlobar effusions are more common on the right side because there are more interlobar fissures and pneumonia is more commonly right-sided. Effusions in the horizontal fissure appear smaller than those in the oblique major fissure which is the interlobar fissure bordering the upper surface of the right lower lobe. In the postero-anterior view it presents a surface which is broad, extensive, and oval in shape. An effusion confined to this area can be mistaken for a large tumor. The lateral view usually establishes the position of this shadow within the interlobar fissure. The following case developed such an effusion and presented many difficulties in diagnosis.

Case 2. M. M., aged 8, on February 27



Fig. 5. Case 2. Interlobar empyema soon after rupture, showing air in upper part of pus pocket.



Fig. 6. Case 2. Lateral film showing interlobar empyema half drained.

became acutely ill following a cold. On March 3, she was admitted to the hospital with symptoms of pneumonia and a temperature of 104° F. Her chief complaint was pain in the right chest and abdomen. Examination revealed typical sign of pneumonic consolidation in the right lower lobe. The organism typed in Group IV. Pain was marked for the first week. There was evidently pleural involvement from the onset.

Temperature began to drop on March 8 and fell below normal on March 10. Thereafter it was rather irregular, with evening rise and continued leukocytosis pointing to suppurative pleurisy. Repeated attempts to find fluid with an aspirating needle failed to locate it.

The first x-ray examination showed consolidation of the right lower lobe. On March 8, the entire right side was obscured and the mediastinum pushed to the left. The impression was that it was a case of pleural effusion. A week later there was

a thin line of translucent resolution above the right diaphragm; otherwise the whole right side was opaque. A film on March 24 showed marked dorsolumbar scoliosis which patient could not overcome. The right chest was still opaque and no encapsulated fluid was made out. On April 10 there was little change in the appearance of the chest except some retraction of the interspaces. Films (Fig. 5) on April 14 showed more clearing above the right diaphragm and a translucent triangular area at the level of the clavicle which was believed to be due to air over fluid. Additional films were made in right and left lateral decubitus which demonstrated very definite fluid levels in an encapsulated area in the mid-lung. Lateral films (Fig. 6) showed the pus pocket clearly, about half full of fluid. Both posterior and lateral films clearly showed this pocket completely surrounded by lung tissue and definitely located it as interlobar.

Clinically the patient had been eating well and gaining weight and was with difficulty kept in bed. She did not complain and was not toxic. The day previous to the discovery of the air in the empyema pocket the patient began to expectorate pus, and it was very evident on viewing the film that the interlobar empyema had ruptured into a bronchus and was evacuating spontaneously. She spit up fairly large quantities of pus on three occasions, and gradually cleared the pocket, which was rather promptly obliterated by the expanding lung.

From the films it is evident that this was a very large interlobar effusion extending the whole length of the major fissure and compressing the surrounding lung. The early pleurisy had apparently sealed this fissure so that it did not communicate with the parietal pleural space. The long-continued obliteration of the entire lung was very puzzling. Over-exposed films failed to demonstrate any encapsulation

until after it had begun to empty. This case did not rupture spontaneously until 43 days after the beginning of the pneumonia.

These two cases seem to indicate that pneumococcic empyema encapsulated mesially or in the interlobar fissures may evacuate spontaneously without leaving bronchial fistulae, as is so often the case when parietal empyemas rupture into a bronchus. This may offer some comfort to the doctor vainly struggling to aspirate interlobar or mediastinal effusions.

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THE VALUE OF THE OBLIQUE VIEW IN THE RADIOGRAPHIC EXAMINATION OF THE LUMBAR SPINE

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THE extreme importance of the radiograph in the study of anatomy and physiology of the spine is generally recognized. The information that has been acquired by the radiological study of the spine has been gained largely from the study of the routine anteroposterior and

of structure, there are parts of the spine that are not adequately visualized by the conventional plates and, in order that all parts of the spine may be seen, oblique plates are often necessary.

One finds reference to the oblique projection of the spine in European literature

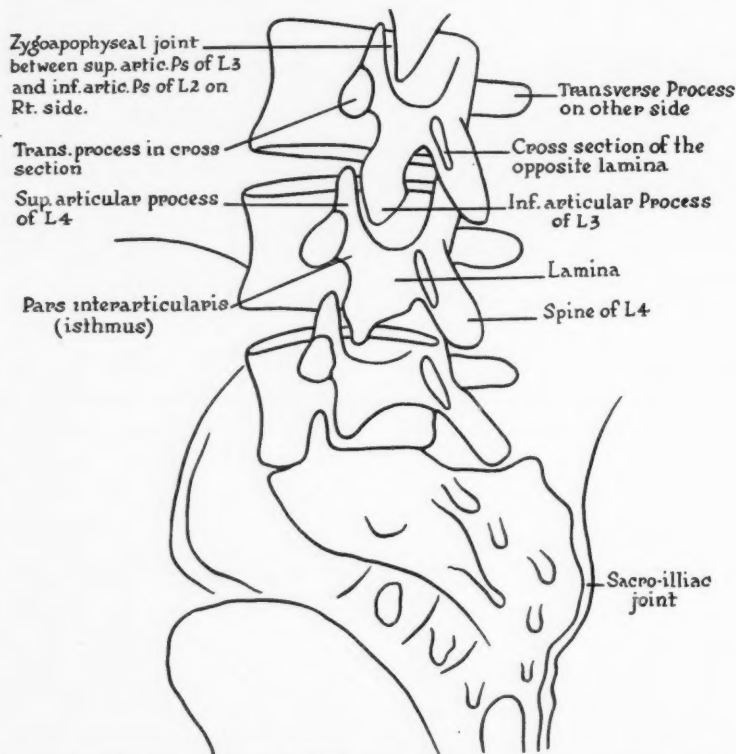


Fig. 1. Diagram of a roentgenogram of the spine showing in particular the right zygapophyseal joints with related structures.

lateral roentgenograms of this region. Each individual vertebra is a complex bony structure and when it unites with the other vertebrae above and below it to form the spinal column, a still more complex arrangement results. Due to this complexity

under the name of the "Dittmar Position." The work of Meyer-Burgdorff (7) and Lange (6) did much to demonstrate the value of this position.

In this country, Hubeny (5) was perhaps the first to call attention to the value of

oblique views. Ghormley and Kirklin (3), Hadley (4), and others have described the technic, and have demonstrated its worth.

In spite of this, I feel that some radiologists do not completely understand the anatomy of the spine as revealed in oblique roentgenograms, and therefore, have not used them to their fullest advantage.

Technic.—The technic for getting satisfactory oblique views of the lumbar spine is not difficult, though sometimes, some ingenuity will be needed to properly show some of the smaller lumbar articulations.

The angle of obliquity of these joints varies from one to another, and between the various joints in the same spine, so that an exact angle to which the patient must be turned, such as advocated by Ghormley and Kirklin, does not seem to be feasible or necessary. For the same reason elaborate protractors or central ray directors are not needed.

The patient is placed on a flat Bucky table with his legs extended and is raised about forty-five degrees toward the side to be examined, that is, if the right facets are being examined, the left side is raised. The hand of the raised side grasps the edge of the table and thus steadies the upper part of the body; the lower part of the body is maintained in an oblique position by sandbags placed under the upper part of the thigh. The long axis of the spine is centered on the table and the central ray is directed to whatever region is being examined. The exposure will be about two and one-half times that given for the usual anteroposterior projection. A suggested setting would be 70 kv.p., 30 in. distance, 50 ma., 8 seconds.

Stereoscopic roentgenograms in the oblique position furnish a splendid means of familiarizing the radiologist with the anatomy of the region, and are of great value in special cases. The shift should be in the long axis of the body.

Radiographic Anatomy.—The radiographic anatomy of the region can be studied best by comparing the radiograph with the articulated spine. In the oblique view, the superior and inferior articular processes

should be well shown and the zygapophyseal joints definitely outlined. The ends of the articular processes are normally

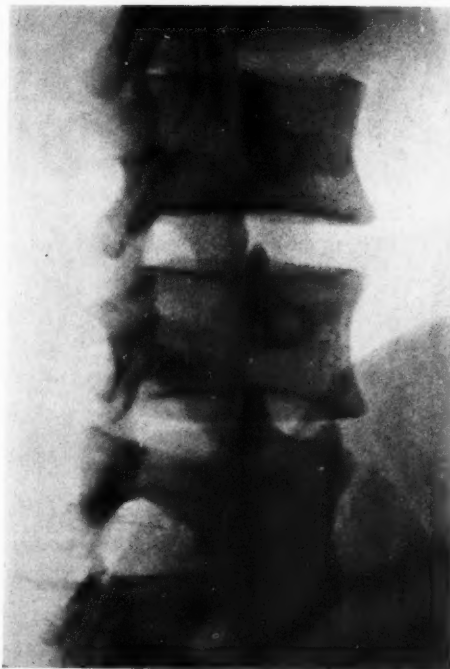


Fig. 2. Roentgenogram of the left zygapophyseal joints in a normal spine.

smooth and round. Pointed or irregular ends indicate pathology. The joint space is normally about a millimeter in width. The joint surfaces are smooth and should be parallel when the patient is in the straight position, but when the back is bent to either side the spaces become wedge-shaped (Fig. 1).

Chandler (2) has pointed out the very great importance of the region known as the "pars interarticularis," or, as he aptly calls it, "the isthmus." This area is that part of the posterior arch where the lamina and inferior articular process join the heavy bony mass made up of the bases of the pedicle, transverse process, and superior anterior process. It is apparently a rather vulnerable region and one that can be adequately visualized only in the oblique position (Fig. 2).

Chamberlain (1) has emphasized the fact that in the oblique radiograph, as one descends, each zygapophyseal joint is

break in continuity can be demonstrated and, also, the loss of the normal relation between the adjacent zygapophyseal joints

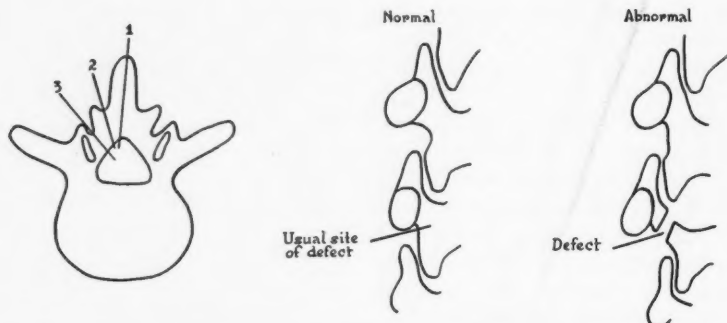


Fig. 3 (left). Diagram showing the locations of separations in the neural arch: (1) defect in the spine; (2) defect in the lamina; (3) defect in the interarticular portion. (Adapted from Willis.)

Fig. 4 (right). Diagram to show site of defect in spondylolisthesis. Note defect in the "isthmus" and the loss of normal relation of the zygapophyseal joints—the lower one on the abnormal side appears posterior.

situated slightly more anterior than the one above it. If this relation is not present, some pathologic processes causing the displacement should be considered.

There is normally considerable variation in the appearance of the spine in the oblique view so that one must not regard as pathologic every slight variation from the textbook normal.

The most important lesions occurring in the lumbar spine in which the oblique view gives valuable information will be discussed.

Separations in the neural arch of the last lumbar vertebra are quite common. These may be bilateral or unilateral and may occur in various regions of the arch. Defects in the arch posterior to its interarticular portion are common and are not usually the cause of symptoms. The familiar spina bifida occulta is an example of this type. Interarticular defects are not so often seen in the routine anteroposterior roentgenograms (Fig. 3).

The demonstration of the presence or absence of a separation in the neural arch is very important in the diagnosis of spondylolisthesis; this can best be done by an oblique ray. In this view the actual

is seen. True lateral roentgenograms will also show the lesion in the isthmus, but the oblique views will tell whether it is unilateral or bilateral and just where it is located (Fig. 4).

In some cases it is exceedingly difficult, particularly in the light of the admittedly debatable etiology, to decide how much of the factor an alleged trauma was in the production of this lesion. In such cases stereoscopic oblique roentgenograms are particularly helpful, showing one if any comminution, callus, or other structure is present that might suggest a recent traumatic fracture. I have been impressed in many cases by the smoothness of the "fracture" line (Fig. 5). Willis (8), whose work on anatomic variation at the lumbosacral junction is outstanding, feels that these are not actual fractures of the bone but rather "actual disunion, the result of trauma to a pre-existing defect so that fibrous or cartilaginous tissue is fractured." However, I believe that actual bony fractures can occur in this region, the result of severe trauma.

Subluxations of the zygapophyseal joints as described by Hadley, are seen quite often. In the anteroposterior view, in the normal

individual, the lateral margin of the lamina, the external aspect of the superior articular process, and the lateral border of the

lamina. No constant distance was noted, there being considerable variation in these distances from one spine to another. Sev-



Fig. 5. A roentgenogram of a case with an interarticular defect.

pedicle form an S-shaped curve. A break in this curve is suggestive of a subluxation and should be confirmed by an oblique view (Fig. 6).

In the oblique view one can see the degree of subluxation and can sometimes demonstrate actual impingement of the upper end of a superior articular process with the lower margin of the pedicle above, or of the lower end of the inferior articular process with the upper margin of the lamina below (Fig. 7). In this connection, measurements were taken in a series of normal spines to determine whether or not there was any constant distance between the tip of the superior articular process and the lower margins of the pedicles and the base of the transverse processes or between the lowermost portion of the inferior articular process and the upper border of the

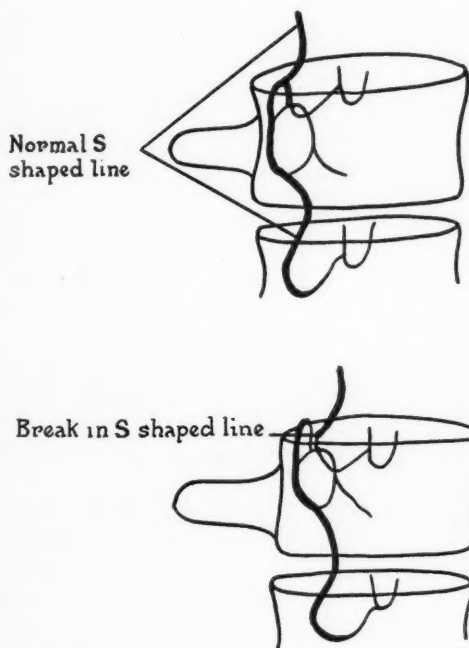


Fig. 6. Diagram to show the normal S-shaped line made up of lateral margins of lamina, superior articular process, and pedicle.

eral points, however, were noted on measuring these distances. They are greater in the upper and middle parts of the lumbar

TABLE I.—DISTANCE FROM THE SUPERIOR ARTICULAR PROCESS TO THE LOWER MARGIN OF THE PEDICLE AND TRANSVERSE PROCESS ABOVE

Vertebra	2	3	4	5
Distance in millimeters	15	14	9	5

TABLE II.—DISTANCE FROM INFERIOR ARTICULAR PROCESS TO THE SUPERIOR BORDER OF THE LAMINA BELOW

Vertebra	2	3	4	5
Distance in millimeters	7	6.5	4.5	4

spine than they are in the lower. Also, the amount of clearance above the superior articular process is more than that

joint surfaces, and by diminution of the joint spaces. The ends of the articular processes are often rough and pointed and

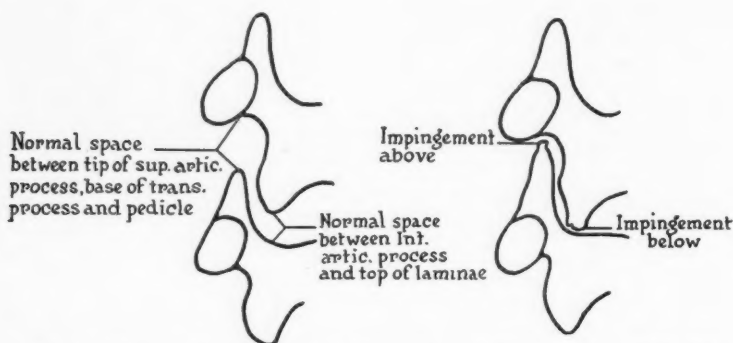


Fig. 7. Diagram to demonstrate the appearance of a partial dislocation with associated hypertrophic changes.

below the inferior articular process (Tables I and II).

If the fifth lumbar lies deep on the sacrum, the distances previously mentioned are less in the lower part of the spine than if it is a high-lying fifth lumbar. The importance of this point is that one should not diagnose impingements or near-impingements in the lower spine without very good evidence, because here the distance between the tips of the articular processes and structures with which they might impinge is less than in other areas of the spine.

Sometimes in a severe injury to the spine, with a compression fracture of the vertebral body, there is an actual dislocation at the zygapophyseal joints. The superior processes get behind the inferior instead of in front, which is the normal relation. This is rather obvious and is particularly well shown when viewed obliquely.

Arthritic changes in the zygapophyseal occur and apparently are the cause of considerable pain in the lower back, though in the examination of the gastro-intestinal tract and kidney, it is not infrequent to observe rather marked changes about these joints. In many of these patients, it is impossible to elicit any history of pain in the back. Arthritic changes are manifest by a loss of the usual smooth margins of the

areas of bone sclerosis are noted about the affected joints.

In that group of cases which go by the names of arthritis deformans, spondylosis rhizomelic, spondylosis ankylopoietica, Marie-Strümpell, and Bechterew's diseases, the oblique projection aids greatly in seeing the nature of the lesion. Destructive changes in the zygapophyseal areas are seen and an ossification of the ligaments about these joints is observed.

The importance of the roentgenogram in the diagnosis of intraspinal tumors is now well known. In most cases the most essential information is obtained on the anteroposterior and lateral examinations, but often additional information can be gained in the oblique projection, particularly in estimating the amount of bony destruction.

Various anomalies of the lumbar spine such as accessory ossicles about the articular processes or abnormal arrangements at the lumbosacral joint are sometimes seen to better advantage in the three-quarters view.

It is often possible to get a view straight through at least the upper part of a sacroiliac joint in this position, which may be of value in certain conditions of sacroiliac disease.

Thus it can be seen that the oblique view

gives added information in various types of spinal conditions. It is not advocated that this position be used routinely, but it should be employed in all cases of spondylolisthesis and in selected cases of obscure back pain. Stereoscopic views in this position are also of great value in teaching, because they give a picture of the anatomy of the spine entirely different from the routine anteroposterior view.

SUMMARY

In order to properly visualize certain areas of the lumbar spine, oblique roentgenograms are necessary. The technic of obtaining this view is described and the normal anatomy, as revealed in the roentgenogram, is discussed. The zygapophyseal joints are best studied in this position. The various lesions occurring in or about them in which the oblique view is particularly valuable are described.

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RADIATION PROCTITIS

A PRELIMINARY REPORT OF 39 CASES¹

By HARRY E. BACON, M.D., F.A.C.S., Philadelphia

ALTHOUGH possibly of a lesser import, one of the fascinating aspects of coloproctology is the occurrence of various processes, extrinsic and remote, which manifest themselves in the rectum or influence its general state. Among these are such conditions as endometriosis, Krukenberg tumor, certain vestigial remnants forming presacral tumors and cysts, metastatic growths in the cul-de-sac from various organs, and radiation proctitis. This latter is encountered with sufficient frequency to warrant consideration, especially since radiation in the treatment of cervical and fundal cancer is advocated by the leading gynecologists in this country and abroad, who feel it to be the method *par excellence*.

As is known, radiation gives rise to congestion and obliteration of the blood vessels. That there is brought about cessation of mitoses and cell division, with subsequent disintegration and absorption of these cells, has been shown. To evaluate better the effect on the rectum, we must appreciate the fact that this regression is followed by fibrosis or connective tissue replacement, which in itself retards cell proliferation.

The effects of radium and the roentgen ray on the rectum were described by Futh in 1915 (3), mentioned by Weishaupt in 1918 (4), and discussed at length by Buie and Malmgren in 1930 (2). By the last two authors this condition is termed "factual proctitis."

Radiation proctitis represents an inflammatory process of the rectum resulting from the use of x-ray and radium, usually in the treatment of extrarectal malignant growths, predominantly uterine; however, other instances have been noted. Appar-

ently radium is the causative factor; in no instance have we observed a similar proctitis following the use of roentgen therapy alone. It has been reported, however, by others, in cases receiving very large total doses of daily fractionated x-ray, after the method of Coutard.

The purpose of this paper is to present data and the findings in 39 cases in which radium, alone or in conjunction with roentgen rays, was employed outside the rectum. Radiation proctitis resulting from the intrarectal use of radium is omitted from this discussion. This series has been collected over a period of time, and each case has been seen personally by the author, either in private practice or in the Temple, Graduate, or Philadelphia General Hospitals.

All the patients were females between the ages of 27 and 69. Four of the most severe cases were in women in their early thirties, three of whom were colored. It is of interest to mention that six patients were exceptionally obese. The entire group were being treated for malignancy of the cervix or body of the uterus, except one, who had a myofibroma. Interstitial intracervical, or intra-uterine radiation was given in the order of frequency. In many, no estimate of the dosage was obtainable. Brust (1) believes that the total number of milligram-hours of radium applied does not seem to bear a direct relationship to the occurrence of proctitis. Buie and Malmgren state that in their series the smallest dose was 800 and the largest 15,100 milligram-hours, with an average of 5,856. So far as we could determine from patients and their records, 12 received no roentgen therapy. It seems only proper to report that the majority of cases, 74 per cent to be exact, received their treatment in hospitals other than those cited above.

¹ Read before the Proctologic Society of the Graduate Hospital, Dec. 15, 1936.

The pathologic changes may be grouped in three stages. The first, congestion or hyperemia, is noted in the early or incipient cases. The process is observed first on the anterior rectal wall. In 65 cases, Buie saw one with the lesion entirely on the right wall, three, on the anterior right wall, and one, lateral and posterior. The author has observed that the lesion usually begins on the anterior wall but is by no means confined to it; at times, the rectum may even be encircled. The process begins approximately from three-quarters of an inch to an inch above the anorectal line, to extend upward for a distance of from one-half to one inch. Examination elicits usually a circumscribed area of thickening not unlike a few layers of thin, wet cardboard in the anterior rectal wall. The mucosa is non-adherent, reddened, edematous, and covered to a slight degree by a non-characteristic mucoid exudate.

The second, or ulcerative, stage is usually quite characteristic as far as the findings are concerned. Here the thickening is more marked, with extension laterally rather than longitudinally. The mucosa seems quite adherent to the deeper layers, a distinct change from the initial stage. Situated on the anterior rectal wall or at times slightly to one side there is a horizontally oval, irregularly rounded ulceration from one-half to one and one-half inches in extent. It occurs as a pearly-white or grayish plaque, giving the impression of being plastered on the surface; but close inspection reveals it to be a necrosis of the mucosa and often the submucosa. Often a dirty-sticky material is present over the surface of the membrane, but this can be swabbed away easily, leaving a clear membrane as above described. The center appears slightly elevated and the edges are somewhat depressed, forming a prominent gutter with the surrounding mucosa. This membrane is quite adherent and tough, so that if it is pulled away a deep ulcer remains which bleeds considerably. After a period of from ten to fourteen days the center is more loose and the edges are elevated and still later the necrotic membrane

begins to slough away. Two cases in this series developed a rectovaginal fistula, which opened exactly in the center of the



Fig. 1. Radiation proctitis showing pearly-white plaque on the anterior wall of the rectum. The elevated borders and telangiectasis may be seen. Case of squamous-cell carcinoma of the cervix, Type 4. Patient had received approximately 11,000 mc.-hr. intracervically and intravaginally.

ulcer. The mucosa immediately adjacent is more or less atrophic and pale, so that the small blood vessels are unduly prominent. This telangiectasis, according to Buie, is pathognomonic.

In the third stage, where a stricture has formed, there is an organized narrowing of the rectal lumen approximately from three-quarters of an inch to an inch and one-half above the anorectal line. It is usually annular, and may be partial or complete, but is devoid of the nodular excrescences usually palpated in primary or extended malignancy. Ulceration is frequent but, because of secondary infection and the progress of the disease, is not characteristic.

In almost every instance the patient will mention that some form of vaginal treatment has been given previously but that now the complaint is rectal. Bleeding is invariably the most common symptom, usually associated with defecation. It may be bright red drops, dark clots, or streaks on the stool. Rarely a profuse hemorrhage is cited. The initial discom-

fort is indefinitely described as a dull, aching sensation; occasionally, however, the pain is of a burning nature. Later, tenes-



Fig. 2. Radiation proctitis showing similar plaque on the antero-lateral wall of the rectum. Telangiectasis is well shown. Squamous-cell carcinoma of the cervix, Grade 2. Patient had received 9,000 mc.-hr. of radium.

mus of varying intensity occurs, the result of sphincteric irritability from the inflammatory process. Such symptoms as frequent and urgent desire for stool, incomplete evacuations, fecal discharges mixed with mucus, pus, blood, and necrotic material are cited in cases in which a stricture is present.

With a history of interstitial uterine radiation and the presence of a pearly-white plaque situated on the anterior rectal wall, there is little difficulty in making a diagnosis of radiation proctitis. However, this process not uncommonly encircles the rectum, in which case it is often no easy matter to decide whether it is the result of radiotherapy or an extension of the malignancy. Of course, the history is of value but does not rule out the possibility of extension. In cases in which malignancy has extended to the rectum there is no typical membrane, and the constriction is irregular and nodular in contrast to the more even distribution of the fibrosis resulting from radiation. Repeated negative biopsies from different portions of the stricture are

the only absolute means of ruling out malignancy.

In first-stage cases the prognosis depends upon the behavior of the growth for which radiation treatment was originally given. If this responds favorably, the rectal complication is relieved, although in Buie's experience there is always some bleeding. The ulcerative group, especially if fistula occurs, has a very problematic prognosis. We say this because a few of the cases in which the primary growth was thought to be controlled failed to respond to proper and regular treatment of the rectal condition. In cases in which stricture is present, of course, the prognosis assumes the doubtful aura that always surrounds this syndrome.

In the first and second stages palliative treatment is usually all that is required, but stricture, as a rule, necessitates surgical intervention. The palliative measures employed are rest in bed, a soft, bland diet, and liquid petrolatum by mouth. Absolute cleanliness will do much in itself to aid healing, and to this end an irrigation of warm potassium permanganate solution, 1:10,000, after each defecation, is helpful. Compresses wrung out in hot boric acid solution and applied to the perineum, and hot sitz baths offer temporary relief. Instillations of warm olive oil, two ounces thrice daily, are soothing and will relieve the tenesmus. Ichthyol, 25 per cent aqueous solution, and hamamelis water lessen inflammation and promote healing, while gentian violet, 1 per cent solution, or balsam of Peru, applied to the ulcerated surface every second day, is also beneficial. Severely painful cases may require surgical intervention, especially if stricture is present. Fourteen patients in the author's series presented stricture of the rectum. In eight of the 14 cases the symptoms were so distressing and the process was so extensive that colostomy was performed. In two of these eight, stricturotomy was first performed, but with only moderate relief. The simplest procedure is to divide the stricture longitudinally in its posterior phase with a cautery and sever the super-

fibers of the external sphincter muscles (posterior sphincterotomy). Good results will be encountered temporarily, but subsequent contraction is to be expected. It would seem, therefore, that except in very early cases, colostomy is the procedure of choice.

SUMMARY

The rectal manifestations following the intravaginal and intracervical use of ra-

dium in 39 cases have been described and an attempt made to classify simply the various stages encountered.

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SIMULTANEOUS LYMPHOSARCOMATOSIS AND CARCINOMA OF THE BREAST IN THE SAME INDIVIDUAL

CASE REPORT

By HERBERT A. JUDSON, M.D., *Los Angeles, Calif.*

INSTANCES of the occurrence of two entirely different types of neoplasm in the same patient at the same time have come within the experience of all radiologists. However, each such occurrence



Fig. 1. Photomicrograph of the section from the breast tumor; carcinoma, simplex type. There are masses and columns of epithelial cells invading a more or less dense stroma. No definite lumen is seen in the masses. The cells are irregular in size and shape, many with hyperchromatic nuclei; an occasional mitotic figure is seen. In some of the groups the cells are very large, with clear cytoplasm and small nuclei ($\times 125$).

has peculiar aspects that make its study of value. The following case presents a number of interesting features and will, therefore, be reported in some detail.

CASE REPORT

K. B., female, single, 62 years of age when first seen, Dec. 27, 1932. She came because of enlarged glands in the neck and axilla and a mass in the breast.

Family History.—Her mother died of cancer of the liver, and one sister had cancer of the breast.

Personal History.—Irrelevant as far as the present report is concerned.

Present Illness.—About one month before entrance, the patient noticed a hard mass in the left axilla, and more recently a lump in the left breast. Several small glands were also felt along the left side of the neck. There had been a feeling of malaise and weakness gradually coming on during the past few weeks. She had lost 15 pounds during the past year.

Physical Examination.—A hard mass was present in the left breast below the nipple, about 4×5 cm. in diameter. There was dimpling of the skin over the mass, and the nipple was retracted. There was a gland the size of a small hen-egg in the left axilla. Numerous small lymphatic glands were present in the left cervical region. Examination otherwise was essentially negative.

Laboratory Findings.—Blood: hemoglobin 84 per cent, red cells normal, leukocytes total count 9,000, lymphocytes 25 per cent, large mononuclears and transitionals 5 per cent, polynuclears 70 per cent, platelets normal. Urine: normal.

Diagnosis.—Cancer of the left breast with axillary metastases.

Operation.—A radical amputation of the left breast was performed Feb., 20, 1933, by Dr. Donald Ross. The microscopic diagnosis was adenocarcinoma of the breast (Fig. 1); benign lymphoma of the axillary lymphatic glands (Fig. 2).

Subsequent History.—The patient made an uneventful post-operative recovery followed by roentgen therapy to the left breast area six weeks after operation. The small glands in the neck receded. In August, 1933, a large gland appeared in the left submaxillary area, which receded promptly with two x-ray treatments.

This recurred and was present when the patient was next seen in May, 1934. The cervical glands were also again enlarged.

part of 1936, the patient developed pleurisy. Death occurred Feb. 20, 1937. An autopsy, performed by Dr. Leo Levi,

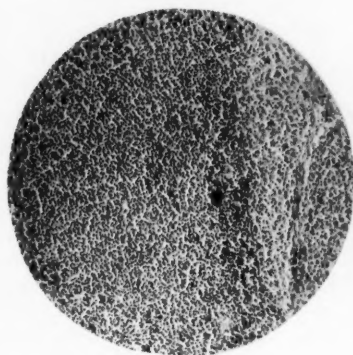


Fig. 2-A.



Fig. 2-B.

Fig. 2-A. Section from the axillary glands, thought to be metastatic carcinoma of the breast, but shown upon microscopic examination to be lymphoma. There are masses of closely packed lymphoid cells, regular in size and shape. Occasional mitotic figures and hyperchromatic nuclei are present. No germinal centers are seen. No definite evidence in this section of infiltrating lymphosarcoma ($\times 125$).

Fig. 2-B. Low power view of the section from the axillary glands. The normal structure of the glands is preserved, and there is little to suggest the widespread invasive lymphosarcomatosis that is to ensue ($\times 10$).

In October, 1934, a peculiar throat condition appeared, with marked enlargement of both tonsils, portions of which hung down into the throat in pedunculated masses. A biopsy specimen of the right tonsil showed lymphosarcoma (Fig. 3). Roentgen therapy was instituted on Nov. 13, 1934, by Dr. Seeley G. Mudd at the California Institute of Technology. Between that date and Dec. 26, 1936, the patient received 34,924 roentgens. This dosage was divided into eight cycles, being directed to several areas (spleen, epipharynx, larynx, chest, anterior left and right thighs, left shoulder, right knee, right lateral forehead), since during the interim in which she was under observation masses became apparent in these several regions. The masses showed uniformly rapid response to comparatively moderate dosage of external radiation.

Of particular interest was the involvement of the stomach and duodenum, manifesting itself by epigastric distress in March, 1936 (Fig. 4). During the latter

showed a well-healed scar over the left chest of a radical mastectomy. No macroscopic evidence of carcinoma was seen. Masses were noted in both groins, in the mid-portion of the right arm, and numerous shot-like nodules were encountered in the subcutaneous tissue. They were firm in consistency, the cut surface having a homogeneous, firm, white appearance. Bilateral pleural effusion was present, the left lung showing a collar of white tissue about the terminations of the bronchi. The stomach and small bowel showed nothing of interest. About 10 cm. below the ileocecal valve, the descending and transverse colon showed pedunculated masses, which on cut section seemed to be composed of homogeneous, ivory-colored, firm material. Similar white, firm, oval masses were seen shining through the capsule of the right kidney, and were found in the spleen, in the lesser omentum, and at the bifurcation of the ilia.

Diagnosis.—Generalized lymphosarcomatosis.

DISCUSSION

The appearance of two totally different biological types of neoplasms in the same

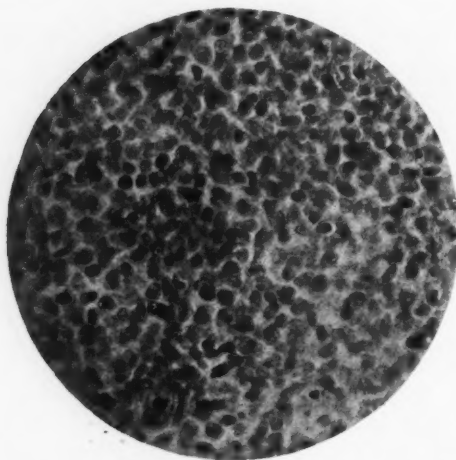


Fig. 3. Section from tonsillar tissue removed by biopsy one and one-half years following the mastectomy; lymphosarcoma, lymphocytic type. The cells are fairly regular in size and shape, but with vesicular nuclei. Numerous mitotic figures and a few hyperchromatic nuclei are seen ($\times 480$).

individual at the same time is not a common finding. It is probably simply a matter of coincidence, and as such is of infrequent occurrence. To enter into any discussion of possible causative relationship is of academic interest only, for there is no reason why a person suffering from one type of neoplasm should not develop another; but this simultaneous occurrence does complicate the problems of diagnosis and treatment. It emphasizes the need to bear in mind that double neoplasms do occur and, although uncommon, need to be watched for.

The present case also illustrates the often insidious onset of the lymphoblastoma group. The presence of a second neoplasm was not suspected when the radical mastectomy was performed. The appearance of the axillary glands, while perhaps suspicious of early malignant changes, was more that of benign lymphoma. There was little indication of the generalized lymphosarcomatosis which

was to follow, involving at one time or another most of the lymph gland-bearing areas of the body, and of which the axillary gland involvement was undoubtedly the apparently innocent forerunner. It was not until later when the tonsils became affected that the malignant changes were unmistakable.

This insidious onset, with its tendency to wider spread, raises the question whether upon finding evidence of malignant change at one point in the lymphatic system, it might be advisable to give prophylactic roentgen therapy to all the lymph gland areas, even to those not as yet openly involved. Experience seems to teach that only infrequently does the disease remain limited to a local area or single organ, and that many cases thought to be localized will later manifest the disease in other areas. Jacox's (1) comparative statistics indicate that systemic irradiation of all lymphoid areas brings better symptomatic response than the more common custom of treating local areas as they become manifestly involved.



Fig. 4. Lymphosarcoma of the stomach, with soft lesions of the rugose, polypoid type. There was little interference with peristalsis. Note the coincident involvement of the duodenal cap.

With either method the response to moderate doses of external radiation is prompt and marked relief may be obtained for a long period of time. Even in cases in which the disease has become so wide-

spread as to make the case seem hopeless, considerable palliation can be expected. Thus in the present instance the patient was kept in comparatively good health for about four years and continued with her work until within a few months of her death; this in spite of the fact that as long as two years before death the disease had invaded at least twelve known cutaneous and subcutaneous groups of glands, beside the deeper areas, the exact number of which could not be ascertained. At autopsy many of the involved areas showed regression and some formerly known to be affected appeared to be free from disease following radiation.

The roentgen examination of the stomach in this case illustrates some of the diagnostic points that have been used in differentiating gastric lymphoblastoma from carcinoma. Upon fluoroscopic examination the lesions were found to be soft, without palpable tumor mass, and not easily discernible. In spite of the thickening and distortion of the rugæ, there was little, if any, interference with peristalsis. This persistence of peristalsis in the face of a definite lesion was mentioned by Holmes (2) as being suspicious of lymphoblastoma, and this finding has been corroborated by Ruggles and Stone (3). The present case also shows definite infiltration of the duodenal cap. Martin (4) has more recently emphasized the diagnostic importance of finding an involvement of the duodenum in conjunction with a prepyloric lesion. Gastric carcinoma rarely infiltrates beyond the pylorus, whereas lymphoblastoma definitely has this tendency. Since, as Carter (5) has shown, malignant lymphoblas-

toma will include more than half of the non-carcinomatous malignant tumors of the stomach, it is particularly important that there be some means of differentiation. These two points—relative lack of impairment of peristalsis in the presence of a gastric lesion, and involvement of both stomach and duodenum—may be of real value when present.

SUMMARY

A case of simultaneous occurrence of lymphosarcomatosis and carcinoma of the breast is presented. Attention is called to the insidious onset of the lymph gland involvement, to the marked regression of multiple lesions with roentgen therapy, and to the possible advisability of early systemic roentgen treatment. The differential diagnosis of lymphoblastoma and carcinoma of the stomach from the roentgen standpoint is discussed.

I wish to thank Dr. Seeley G. Mudd and Dr. Leo Levi for their courtesy in supplying many of the data used in this report.

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NON-SCREEN PROCEDURE WITH THE POTTER-BUCKY DIAPHRAGM

PRELIMINARY REPORT

By GLENN W. FILES, *Chicago*

DURING the last few years changes have been made in x-ray film to make it increasingly selective to the longer wave lengths emitted by intensifying screens. Obviously, these changes in emulsion have contributed materially to the increase in so-called speed of film with which intensifying screens are employed.

The actual speed of regular x-ray film emulsions, when used without intensifying screens, has changed but little during the past ten years.

The character of regular x-ray film emulsion has also been changed, to provide increased contrast. In fact, up to two or three years ago there appeared to be a strong rivalry to see who could put the most contrast in the finished roentgenogram. However, this increased contrast in present-day radiographs is available only when regular x-ray film is used in combination with intensifying screens.

It is generally recognized that radiographs made without intensifying screens show a marked increase in sharpness of detail or definition. Because of this increase in sharpness of detail, a non-screen procedure has been utilized for the lighter extremities for many years. However, non-screen procedure, as we have considered it in the past, could not be extended to heavier parts of the body, because the relatively low speed of the film has made necessary such high energy values for the heavier or more opaque parts of the body.

The advent of the rotating-anode tube, with its extremely small effective focal spots, served to accentuate the fact that while contrast is an important factor, detail sharpness or definition is, after all, of first importance. To the demands of the radiologist for increased detail sharpness, screen manufacturers responded with detail screens, which, although somewhat

slower than Hi-Speed screens, make possible sharper definition.

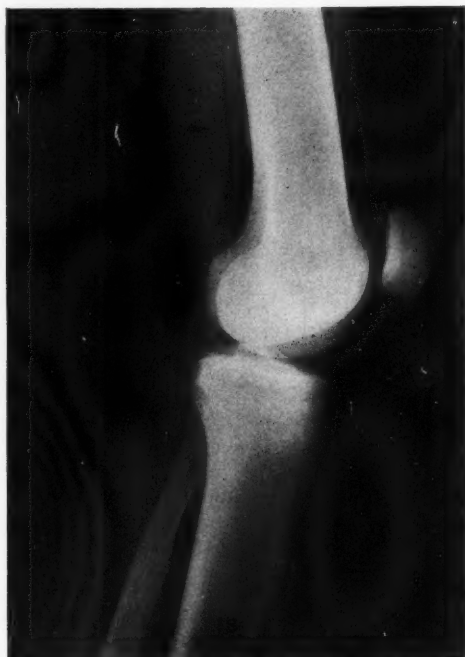
Despite the improvement in detail sharpness brought about through the use of finer grained intensifying screens, roentgenograms made without screens were still far superior in respect to actual sharpness of detail.

Approximately two years ago, the Agfa-Ansco Company, of Binghamton, N. Y., made available a non-screen film having approximately twice the speed of regular x-ray film. Its emulsion was entirely different from regular x-ray emulsion, in that it was selective to the shorter wave lengths of x-ray rather than to the longer wave lengths emitted by intensifying screens. Because of its selectivity, this film could not be employed with intensifying screens.

The increased speed of the non-screen film, as compared with regular x-ray film when used without intensifying screens, was brought about with no sacrifice in detail sharpness, and it made possible the production of roentgenograms of increased brilliancy and contrast, even though the milliamperes-second value was only half that ordinarily employed for regular film used without screens.

The results obtained in the less opaque areas of the body, such as extremities, were a decided improvement over those obtained with regular x-ray film, but it was soon observed that the non-screen film showed the greatest improvement when the kv.p. value, rather than milliamperes-seconds, was decreased. This is because the non-screen film is more sensitive to secondary fog than is the regular film without screens, and an obvious result with an emulsion made selective to the shorter wave lengths.

Realizing that this increased sensitivity to secondary radiation might make non-



Figs. 1-A and 1-B. Illustrating the difference in density between regular film produced without intensifying screen and the new Agfa non-screen film—exposed simultaneously in the same cardboard holder.

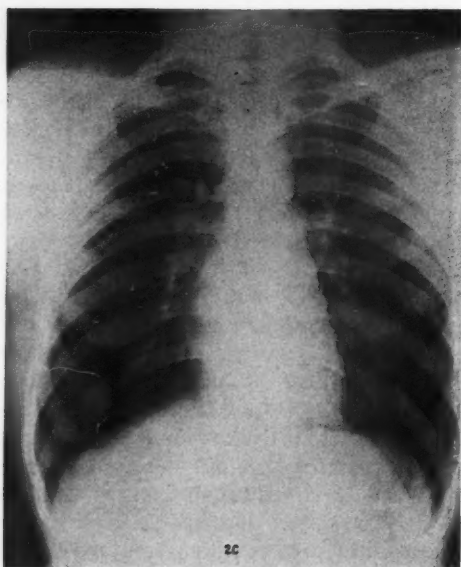
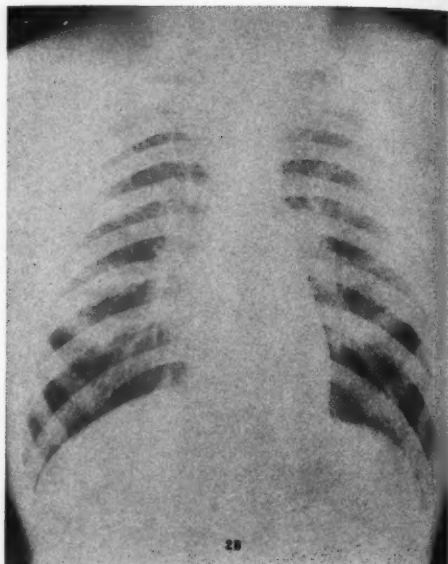
screen film adaptable to a Potter-Bucky diaphragm procedure, members of the General Electric X-ray Corporation's Technical Service Department began to investigate the possibilities.

The results subsequently produced with the Bucky diaphragm, even on areas as thin as a hand and up to the thickness of the average shoulder, were startling. Introduction of the Potter-Bucky diaphragm into this procedure indicated that a new and considerably higher baseline for diagnostic roentgenography was not only possible, but also practical, for virtually all extremity work up to and including the shoulder.

When the Potter-Bucky diaphragm was employed, non-screen film made possible practically any desired degree of contrast, and furthermore, this contrast could be retained even though comparatively high kv.p. values were used. This gave the roentgenograms an appearance of transparency not obtainable by any other known

means. The unusual latitude made possible with the Potter-Bucky procedure enabled us to produce seemingly impossible results with areas of widely different opacities. In roentgenograms of a lateral knee, for example, taken at voltages sufficiently high to completely penetrate the lower extremity of the femur, no portion of the patella was obliterated. In fact, the radiographic density through the region of the patella was only slightly greater than the density through the much heavier part of the knee. Despite the high voltage value employed, the highest degree of detail visibility, in the form of contrast, was retained. It was found that variations as high as five or six kilovolts, either way from a given setting, made comparatively little difference in the quality of the end-result.

Thus it was apparent that a new and valuable procedure, of great assistance to the radiologist in the diagnosis of minute lesions, could be established with the non-



Figs. 2-A, 2-B, and 2-C. These three roentgenograms were made with intensifying screens and regular film, using 7 milliamperes-seconds on each. 2-A was at 50 kv.p.; 2-B at 65 kv.p., and 2-C at 80 kv.p.

screen film. Roentgenograms made with a sufficiently small effective focal spot permitted the use of a magnifying glass of between 2- and 3-power, without loss of detail sharpness.

It should be obvious that any procedure which makes possible a considerably wider latitude in technic and, at the same time, produces diagnostic results of a higher order, is most desirable. The non-screen film made this possible for the less opaque areas of the body, but energy requirements were such that it was not feasible to extend the procedure beyond the roentgenography of extremities, or other light areas such as the nose.

A few days prior to the meeting of the Fifth International Congress of Radiology in Chicago, however, Agfa-Ansco more than doubled the speed of the non-screen film. Experiments with several dozen of these films made available for the purpose of testing, proved not only that the new non-screen emulsion had more than twice the speed of the first non-screen film, but also that it was just that much more sensitive to secondary fog.

Again the Potter-Bucky diaphragm procedure was employed, and, as in the case of the first non-screen film, secondary fog was entirely eliminated.

Surprising as it may seem, the greatly increased speed of the film does not detract from its unusual latitude, nor does it make

necessary a reduction in kv.p. to maintain the desired contrast. Comparison of roentgenograms made on the first non-screen film with those made on the new non-screen film, using the same kv.p. value with the Bucky diaphragm and changing milliamperes-seconds only to maintain density, reveals no noticeable difference in contrast. Therefore, much has been gained and nothing lost by this increase in speed.

Dr. Hollis E. Potter, of Chicago, in his early work with the Potter-Bucky diaphragm, did not use intensifying screens. Using plates at the outset, and later duplicated film, his was undoubtedly the first non-screen Potter-Bucky procedure. At that time, however, it was necessary to use an enormous amount of energy, because of the slower speed of plates and films, and this imposed so many limitations that it was not considered practical for use generally.

Since this original work of Dr. Potter's, there is no available record of a combined non-screen Potter-Bucky procedure for the heavier and more opaque areas of the body. We deem it a privilege, therefore, to present a thoroughly practical, non-screen Potter-Bucky diaphragm procedure, the result of which makes possible an entirely new standard of diagnostic value, as it may be effected by materially increasing sharpness of detail or definition.

We realize fully that there are other very important factors, some set and some variable, which can alter detail in a roentgenogram: for example, size of tube focal spot, focal-film distance in relation to object-film distance, motion of part or object during the exposure, and even grain size in the film itself. It is also realized that the work thus far must be considered as only preliminary. If sharpness of detail or definition is as important from a diagnostic standpoint as the radiologist has convinced us it is, then we believe that we are justified in presenting this new procedure as a ground work for something better in the future. There is no gainsaying the fact that, in the light of present knowledge, the

same sharpness of detail cannot be produced with intensifying screens as can be produced without, yet it is not beyond the bounds of possibility that future improvements in intensifying screens may make possible equally good or even better results.

In reviewing this work up to the present time, however, and since it was passed upon most favorably by several hundred radiologists at the Fifth International Congress, there seems to be no doubt but that this procedure may have a far-reaching effect in improving diagnostic results, particularly in the hands of the radiologist.

Results obtained thus far with non-screen Bucky diaphragm procedure may be compared to intensifying screen procedure by a somewhat broad division of the three distinct advantages which the non-screen procedure seems to offer: first, the improvement in definition or sharpness of detail; second, the extraordinary latitude present in this procedure; and third, the increase in visibility of certain structures which heretofore have been either invisible or could be made visible only through some highly specialized procedure.

DETAIL

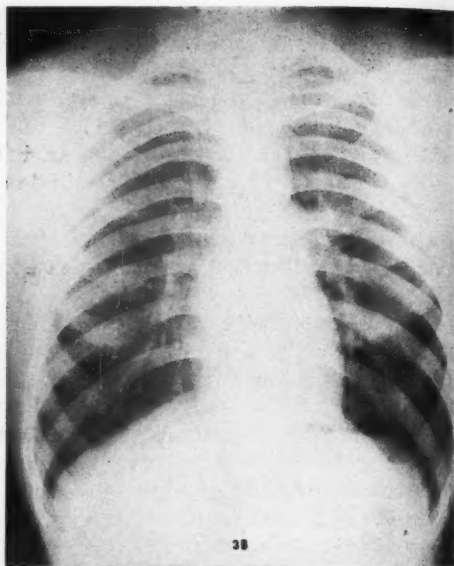
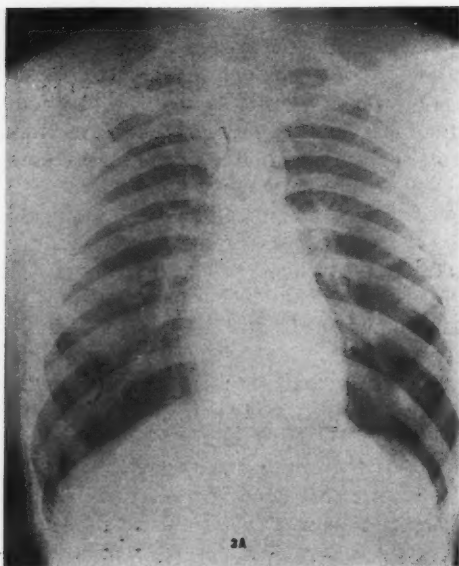
Because the non-screen film is equally as fine-grained as the regular x-ray film, it is obviously necessary only to compare detail in films taken with screens with that in films taken without screens.

Therefore, insofar as actual detail sharpness is concerned, one need only consider, for example, the difference between films of a hand taken without screens and a hand taken with screens. This difference is so generally well known, however, that discussion seems unnecessary.

The problem of screen contact is, of course, ruled out entirely, as the non-screen film presents no problem of screen contact.

Obviously, the relation of focal-film distance or object-film distance to sharpness of detail will be the same with the non-screen film as it is with regular film used with screens.

The problem of motion and its influence



Figs. 3-A, 3-B, and 3-C. These three roentgenograms were made with the new Agfa non-screen film—3-A at 50 kv.p.; 3-B at 65 kv.p., and 3-C at 80 kv.p. In this instance 40 milliamperes-seconds were used on each film. The considerable difference in latitude as between the non-screen procedure and screen procedure is distinctly shown. As explained in this article, the so-called factor of 6-1 as between these procedures must be approximate, because of the variation in screen speed as penetration is changed. It is generally understood that the speed of intensifying changes considerably

between 30 and 50 or 55 kv.p., but that from 55 kv.p. up to 80 kv.p. the change is not quite so apparent.

upon sharpness of detail is well known. Inasmuch as the speed of this new non-screen film is considerably slower than that of a regular film when used with screens, there no doubt exists a greater danger from the effects of motion when using the non-screen film.

However, certain compensating factors may be utilized with the non-screen film, which will be discussed later on in this article.

LATITUDE

The latitude of the non-screen film, whether used with or without the Bucky diaphragm, is considerably greater than any intensifying screen procedure. As previously mentioned, the kv.p. value may be varied as much as five or six kilovolts above or below a given procedure, yet the change in density in comparison with screen radiographs is relatively small.

It will be found, however, that the latitude, so far as voltage is concerned, is greater when using the Potter-Bucky diaphragm than when it is not employed.

Likewise, it will be found that this latitude varies, depending upon the part or area being exposed. For example, the latitude is not as great in the case of a part as thin as the hand, as it is for an anteroposterior lumbar spine.

GENERAL FILM QUALITY

One of the outstanding features of this film is a certain quality that is exceedingly difficult to describe successfully. The type of emulsion, and its so-called emulsion curve, probably bring about this change in quality which seems to be characteristic of all roentgenograms taken with it.

In the first place, we find that either with or without the Bucky, a change of 20 kv.p. is required within the range of 55 kv.p. and 90 kv.p., in order to either double the film density or reduce it by one-half. That is, if the factor of penetration is being utilized as the variable, a change of approximately 20 kv.p. is necessary to actually double the density. This factor of 20 kv.p. is approximated, because again it will be found that the thickness of the part has something to do with the necessary change in penetration, to increase or decrease density a given percentage.

The effect of kilovoltage change when using this non-screen film with the Potter-Bucky diaphragm is considerably different than the effect of wide kilovolt peak changes when using films with intensifying screens. Inasmuch as this film does permit wide variations in penetration without materially altering the contrast, we find that for certain areas, such as the spine in the anteroposterior position, comparatively high penetration values are employed, which result in roentgenograms somewhat transparent in appearance. In other words, certain portions of the spine are distinctly visible, one portion through the other, yet despite this high penetration and visibility of the spine, the soft tissues are not eliminated. As a matter of fact, an excellent combination of bone and soft tissue delineation is obtained.

In addition, the character of the emulsion permits roentgenograms to be made of

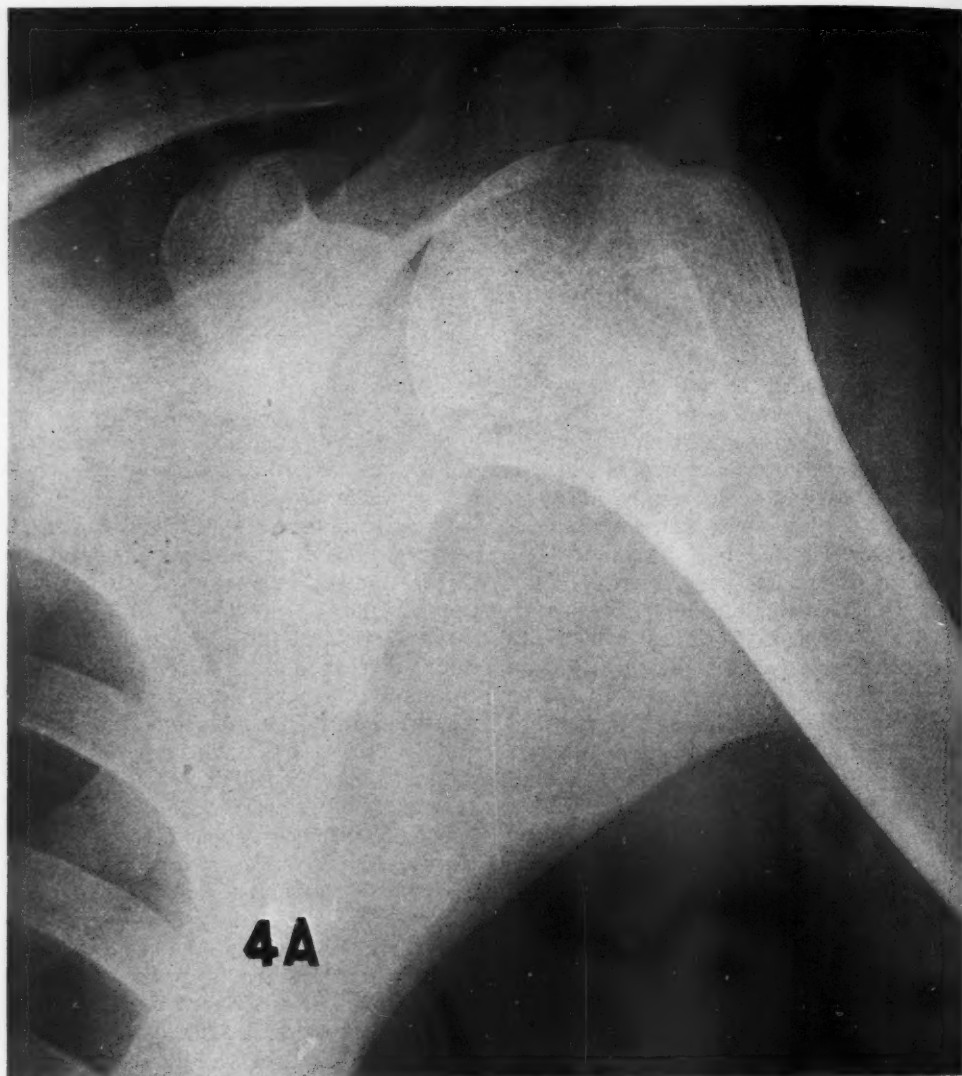
areas wherein a wide difference in opacity is shown, without the obliteration of areas of the least opacity. For example, in radiographing the chest with the speed-Bucky, we find it comparatively easy to make the dorsal spine distinctly visible, as well as the interspaces between vertebræ, and yet the lung structure itself is not obliterated. As a matter of fact, the lung structure is usually of about average density, despite the visibility of the dorsal spine through the heart shadow. Roentgenograms of heavy consolidated areas, with the Bucky diaphragm, will show that both the opaque and heavy consolidation have been well penetrated, yet other areas in the chest, and of considerably less opacity, are distinctly visible.

Thus we have results which are balanced in density, and under certain conditions this feature will be found to be very much worth while.

At the present time, at least, there are certain limitations to the widespread general use of this new non-screen film. The speed factor, for example, is such that for certain areas and for unusually heavy individuals, the energy necessary is completely outside the range of practical work. Therefore, intensifying screens are essential for these areas, and for those individuals coming under certain classifications.

Obviously, the best results will be obtained in those areas wherein a certain differentiation in structure exists. This is because the slower speed of the non-screen film, in comparison to films with screens, makes it impractical to reduce the penetration value below a certain point for certain areas, because of the tremendous increase in milliamperes-seconds which the lower voltage values would require. Consequently, certain areas are omitted from the accompanying technic chart, as well as certain limitations as to the size or thickness of the patient.

The actual speed factor of this film, compared to that of regular x-ray film without intensifying screens, is approximately 5.5 to 1. To explain further, all other factors being equal, slightly less than one-



Figs. 4-A and 4-B (*opposite page*). Illustrating the difference in quality as between Bucky roentgenograms on regular film and Agfa non-screen film.

fifth the number of milliamperere-seconds are required for non-screen film as for regular film *without* screens. If it is desired to utilize the same number of milliamperere-seconds, and reduce the penetration instead of milliamperere-seconds, the difference is approximately 20 kv.p.

In comparing the actual speed of this new non-screen film with that of the regular film when used with Patterson Par-Speed

screens, it will be found that the screen procedure at equal kv.p. values will require approximately one-sixth the number of milliamperere-seconds. Again we wish to point out that this is approximate, and that it will show certain variations, depending upon the thickness of the part as well as the penetration value.

It should be borne in mind, however, that the non-screen emulsion and the reg-

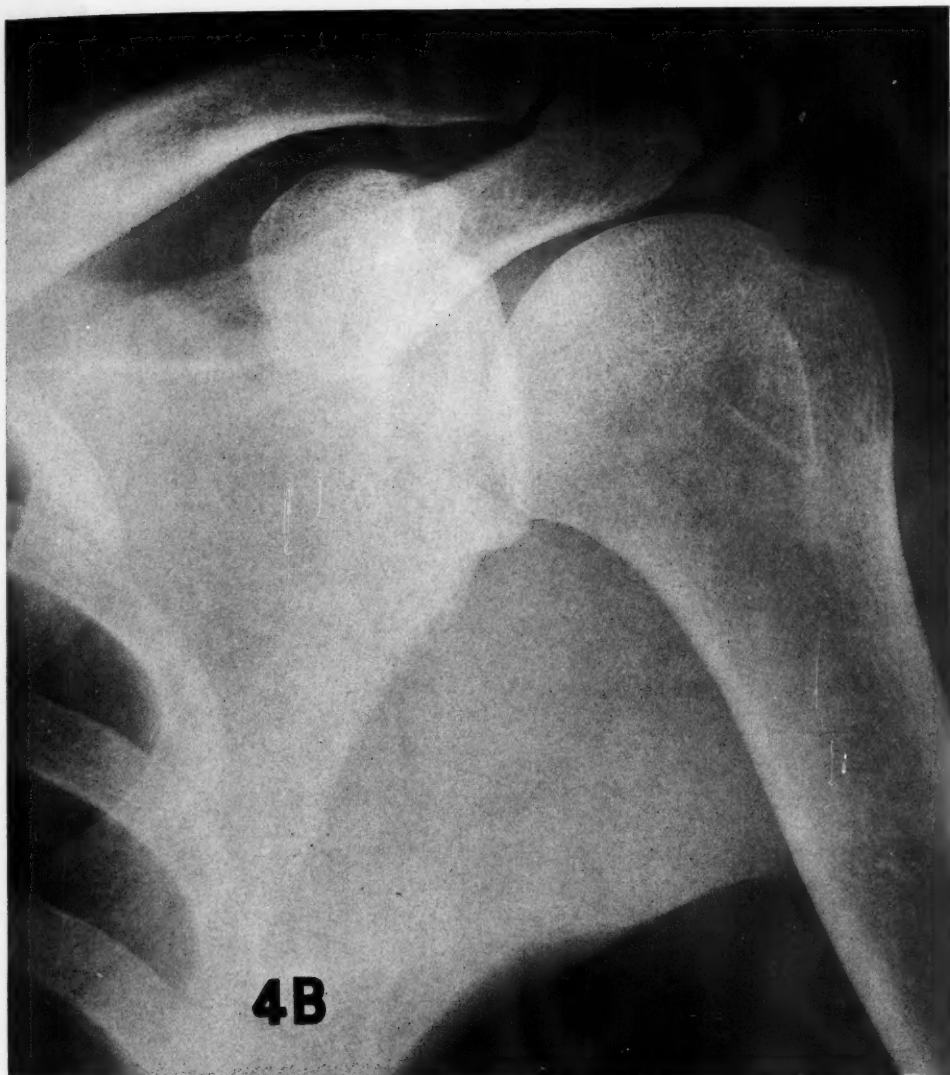


Fig. 4-B. (See opposite page.)

ular film emulsion are entirely different in their characteristics.

While it is perfectly true that when using the Bucky diaphragm with the non-screen film, as compared with regular film and Par-Speed screens, there may be a difference of 600 per cent in exposure time at the same penetration value, there are certain compensatory factors which alter the situation.

As already mentioned, wide voltage changes are permissible when using the non-screen film; furthermore, much higher penetration values can be employed with the non-screen film and the Bucky diaphragm, without detracting from its diagnostic value, than can possibly be employed when using intensifying screens.

The fact that considerably higher penetration values can be utilized with the non-



Fig. 5-A. Made with intensifying screens and regular film. Factors employed: 65 ma.-sec.; 36-inch distance; 68 kv.p.



Fig. 5-B. Made with the Potter-Bucky diaphragm and the new non-screen procedure. Factors employed: 400 ma.-sec.; 36-inch distance; 68 kv.p.; and the 1 mm. focal spot of the rotating anode tube.

screen film (and should be utilized if proper quality is to be obtained) makes possible a reduction in milliamperes-seconds, which in roentgenography of the heavier areas, for example, would be approximately only twice that required with the intensifying screen procedure.

Were it necessary to make up the difference in speed through the utilization of milliamperes-seconds alone, *i.e.*, by a 600 per cent increase in either time or milliamperage, use of the new film would obviously be quite limited. Therefore, by compensating for a portion of this difference in speed, through the utilization of higher penetration values, it is ordinarily necessary only to double the milliamperes-second value usually recommended with intensifying screens. In some instances, the milliamperes-second value is virtually the same, the entire difference being made up in penetration—this applies particularly to areas of lesser opacity.

Because of the increased sensitivity of this film to the shorter wave lengths, and because of the difference in threshold speed between this film and the so-called regular film, it is essential that cones or diaphragms be employed for certain heavier and more opaque areas, in addition to the Potter-Bucky diaphragm.

In general, roentgenograms of the dorsal and lumbar spines, sacrum, and hip should be taken with a diaphragm or a cone, which, if square, should cover a film area no larger than 12×12 inches; in the case of a round cone, the diameter should not exceed 12 inches.

As with all procedures, non-screen or others wherein roentgenograms are made with the Potter-Bucky diaphragm, the smaller the area exposed, the greater will be the resultant differentiation of tissue.

It will be found that when smaller areas are exposed, a change in technical procedure must be made to compensate. That is, the smaller the exposed area, the greater the energy necessary, and *vice versa*. It is not practical to give any table, because of the wide variations in exposed areas due to variable focal-film distances, variable sizes

in cones, or variable sizes in diaphragms.

The processing technic with this non-screen film is practically the same as for regular film, with some modifications. Our best results thus far, from the standpoint of developing, have been 7 minutes at 68° F.; 5.5 minutes at 70° F.; 4.5 minutes at 72° F. Our experiments seem to indicate that 65° is about the minimum temperature that can be successfully used, even though compensation is made by increasing the developing time. That is to say, at 65° the developing time is of the order of 9 or 10 minutes, while at 63°, 13 to 15 minutes are required.

The non-screen film should be developed by timing because of the difficulty of visual inspection. With the average red light in the darkroom, the film appears to be perfectly black.

Between the developer and the fixing bath, at least 10 seconds' rinsing is required.

It will be noted that this film requires approximately double the time to fix completely, as regular x-ray emulsion. This is particularly true where a considerable amount of unexposed film area must be fixed.

It will be noted generally that after the film has been fixed, a smoky appearance remains. This can be removed in the wash water. If the fixing bath is fresh, it may take 5 to 10 minutes to remove all of this discoloration—less as the fixing bath gets older.

The film should be washed the same length of time as for regular x-ray emulsion.

Because of the difficulty of properly demonstrating sharpness of detail through reproduction, the accompanying illustrations and comparisons really do not do this new film justice. However, we have attempted to bring out certain features of the film, as explained with each illustration.

CONCLUSION

A new non-screen film is described which, because of its general characteristics and high speed, makes it adaptable for a wider

range of non-screen roentgenography than has been possible heretofore.

A non-screen Potter-Bucky diaphragm procedure, for not only the thinner, less opaque areas of the body, but also for the heavier parts, is described.

The generally improved roentgenographic quality, due to a decidedly increased sharpness of detail or definition when using this new non-screen film, seems to predict great steps forward in the production of diagnostic films.

The procedure is one which, when placed in the hands of the specialist, gives great promise of making possible the diagnosis of very early pathology such as in many instances heretofore has escaped attention because of its invisibility.

Definite technical procedures are given for various areas and parts of the body, wherein this film offers distinct advantages over roentgenograms taken with screens. These technical procedures have been carefully chosen to combine roentgenographic results of the highest quality, within practical energy requirements.

It is believed that this new non-screen film opens up an entirely new diagnostic field, and that it is the fore-runner of a future roentgenographic quality, destined to add appreciably to the information which the specialist may obtain from roentgenographic studies, especially in cases in which diagnosis depends upon visibility of minute lesions.

TECHNICAL PROCEDURE

The following technical procedures for the various areas and groups are based upon the utilization of a Potter-Bucky diaphragm and the new non-screen film.

The procedure as given will naturally vary, particularly the penetration value, depending not only upon the preference in radiographic density, but also type of equipment, type of Potter-Bucky diaphragm, certain variables which may occur in the darkroom, and many other factors too numerous to mention.

The specific values of kv.p., however,

should not differ, under proper operating conditions, more than 10 kv.p. from these values given in the chart. In other words, a 10 kv.p. variation, up or down, on a particular equipment based upon the values as given, indicates a greater than normal variation.

Inasmuch as greater energy than ordinarily employed with intensifying screens is utilized, care should be exercised at all times that the limit of the tube, as regards energy and cooling time, be given added consideration.

The values as given are based upon kilovolts peak as the variable factor.

Instead of definite milliamperage and exposure time values, the two are combined and milliamperage-second values are given. This in view of instances wherein x-ray tubes of widely varying capacity are employed. Therefore, milliamperage-second values and kilovolt peak values are based upon average working conditions, and with fresh chemicals.

EXTREMITIES

This group includes the hand in both positions; wrist in both positions; elbow in both positions; shoulder, either antero-posterior or postero-anterior; foot, antero-posterior and lateral; ankle in both positions; knee in both positions.

In this group it is deemed essential to use either a cone or a diaphragm, unless otherwise desired by the operator.

Technic:

200 ma.-sec.—40-inch distance—from 40 kv.p. for average hand to 73 kv.p. for average shoulder.

Head

Skull, P.A. or A.P.: 200 ma.-sec.; 30-inch distance; 85 kv.p.

Skull, lateral: 200 ma.-sec.; 30-inch distance; 75 kv.p.

Maxillary Sinus, P.A.: 200 ma.-sec.; 30-inch distance; 85 kv.p.

Frontal Sinus } P.A.: 200-ma.-sec.; 30-
Ethmoid Sinus } inch distance; 80 kv.p.

Sinuses, lateral: 200 ma.-sec.; 30-inch distance; 70 kv.p.

Mastoid, lateral: 200 ma.-sec.; 30-inch distance; 80 kv.p.

Nose, lateral: 200 ma.-sec.; 40-inch distance; 65 kv.p.

It is recommended that a cone or diaphragm be used to cover exactly the area or part. In the case of a lateral skull, for example, the cone should be sufficiently large to include the entire skull. On the other hand, in the case of an area such as a mastoid, the cone should be only large enough to cover the area desired.

Trunk

Atlas—Axis, A.P. (mouth open): 200 ma.-sec.; 22-inch distance; 60 kv.p.

Cervical Spine, A.P. and lat.: 200 ma.-sec.; 40-inch distance; 75 kv.p.

Dorsal Spine, A.P.: 200 ma.-sec.; 40-inch distance; 80 kv.p.

Dorsal Spine, lat.: 200 ma.-sec.; 40-inch distance; 70 kv.p.

Note: The technical procedure for the dorsal spine in the lateral position is based on the patient taking a full breath and holding it during the exposure.

Lumbar Spine, A.P.: 400 ma.-sec.; 36-inch distance; 70 kv.p.

Sacrum, A.P.: 400 ma.-sec.; 36-inch distance; 70 kv.p.

Pelvis or Hip, A.P.: 400 ma.-sec.; 40-inch distance; 70 kv.p.

Sternum, P.A.: 200 ma.-sec.; 25-inch distance; 60 kv.p.

Sternum, lat.: 100 ma.-sec.; 36-inch distance; 75 kv.p.

Ribs, A.P. or P.A. { Above diaphragm: 100 ma.-sec.; 30-inch distance; 70 kv.p.
Below diaphragm: 200 ma.-sec.; 30-inch distance; 75 kv.p.

Organs

Chest. P.A. { Without Bucky: 40 ma.-sec.; 48-inch distance; 70 kv.p.
With Bucky: 80 ma.-sec.; 48-inch distance; 75 kv.p.

Kidney, A.P.: 150 ma.-sec.; 36-inch distance; 70 kv.p.

Urinary Bladder, A.P.: 150 ma.-sec.; 36-inch distance; 75 kv.p.

Gall Bladder, P.A. or A.P.: 150 ma.-sec.; 30-inch distance; 70 kv.p.

Stomach { P.A. or A.P.: 150 ma.-sec.; 30-inch distance; 75 kv.p.
Semi-lateral: 150 ma.-sec.; 30-inch distance; 80 kv.p.

Colon, A.P.: 150 ma.-sec.; 40-inch distance; 80 kv.p.

For radiography of infants and children, using a non-screen Potter-Bucky diaphragm procedure, it will be found advisable to either reduce the penetration 15 to 20 kv.p. from the values given for average adult in the above group, or reduce the milliamperes-seconds to half that given above, and utilize the recommended kv.p. for adults.

To reiterate, the above given settings can be considered only approximate, but they should serve as a starting point, rather than to leave everything to conjecture. Insofar as is practical, it is our belief, based on our experiences to date, that the milliamperes-second value should be maintained as nearly as possible. The distance values as given may, of necessity, have to be changed, depending upon the installation. In the event that the distance must be changed, which under ordinary circumstances would be a reduction, then the milliamperes-seconds may be changed according to the inverse square law.

In radiography of areas such as kidney, lumbar spine, hip, sacrum, etc., it is recommended that not only a rubber bag be employed as a means of compression, but also an immobilizing band, usually available wherever the Potter-Bucky diaphragm is used.

It is difficult to stipulate any limitation either as regards thickness of part or type of individual. However, in the case of chest radiography without the Potter-Bucky diaphragm, our experience thus far has indicated that a chest in excess of ap-

proximately 9.5 inches in thickness usually is not improved through the use of the non-screen film.

When the Potter-Bucky diaphragm is employed, using the technical procedure as given above, virtually any chest thickness will show a decided improvement, from the standpoint of detail sharpness. Ordinarily chest procedure with the Potter-Bucky diaphragm is undertaken when certain types of pathology exist—particularly consolidation. It is in this type of work that the non-screen Potter-Bucky diaphragm procedure should add considerably to the diagnostic value of the chest roentgenogram.

This new type non-screen film has been

available only about six weeks. During this time, it has been necessary to accumulate just as much information as possible in order that such information might be passed on, even though it be purely preliminary.

I wish to express my sincere thanks and appreciation to my co-workers, without whose co-operation it would have been impossible to present a preliminary report at this time: Messrs: H. O. Mahoney, J. B. Thomas, F. G. Davis, J. Dee, John Armstrong, Charles Minnich, M. Fagen, and Paul Freer. They have worked diligently in order that more than two thousand roentgenograms and comparative studies could be made in these few short weeks.

CARCINOMA OF THE JEJUNUM

By BERNARD KALAYJIAN, M.D., *Charleston, S. C.*

Report of work done in the Department of Roentgenology, Methodist Hospital, Indianapolis, Indiana

CARCINOMA of the small bowel occurs infrequently enough to stimulate more than ordinary interest from a diagnostic standpoint. According to Barnhart (3), 77 such cases had been reported up to 1931. Since that time, the author has been able to find approximately

evidence in the literature of predisposing factors or hereditary effects.

The pathology is usually that of an annular adenocarcinoma, although other types such as malignant degeneration of polyps, malignant transformation of pancreatic rests, colloid carcinoma, and expansile

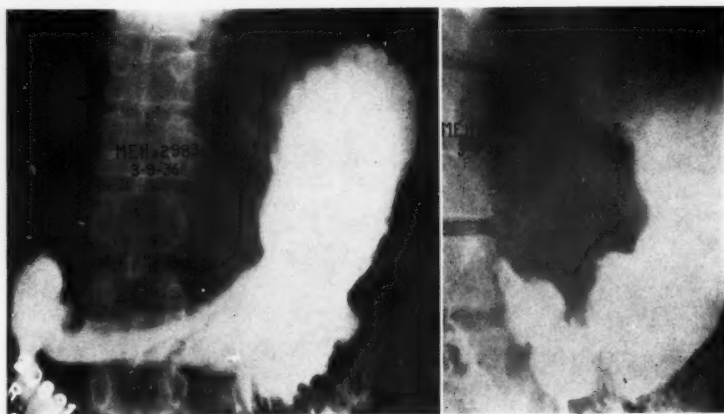


Fig. 1. Case 1. Posterior-anterior and oblique views of stomach and duodenum, March 9, 1936.

35 additional case reports. Since the diagnosis of this disease can frequently be made by the roentgenologist alone, the author wishes to add two cases to the literature, in one of which a pre-operative diagnosis of carcinoma was made from the roentgen findings.

The exact etiology of this disease is unknown. Multiple reasons for the infrequency of carcinoma in this region have been given, including the fluid content of the bowel, the alkalinity of this content, and the absence of sharp bends in the bowel. The age incidence is approximately the same as for other carcinoma. The average age is variously given, but most authors agree on 47 or 48 years. The case reports indicate a predominance of males in a two-to-one ratio. There is no

ulcerated and non-ulcerated lesions have been described. The annular lesions are almost invariably constricting in type. Metastases are frequently found rather early, according to the more recent authors, although in the past it has been considered that this type of carcinoma metastasized rather late. The metastases are first to the local lymph glands, then to the liver, long bones, lungs, ovary, dura, etc.

The symptoms of the disease depend largely on the speed of development of mechanical bowel obstruction by the tumor mass, rather than on cachexia from the tumor itself. In the slowly growing tumors, there is often a period of from three months to a year or more, in which the patient complains only of indefinite abdominal distress, which is unrelated to

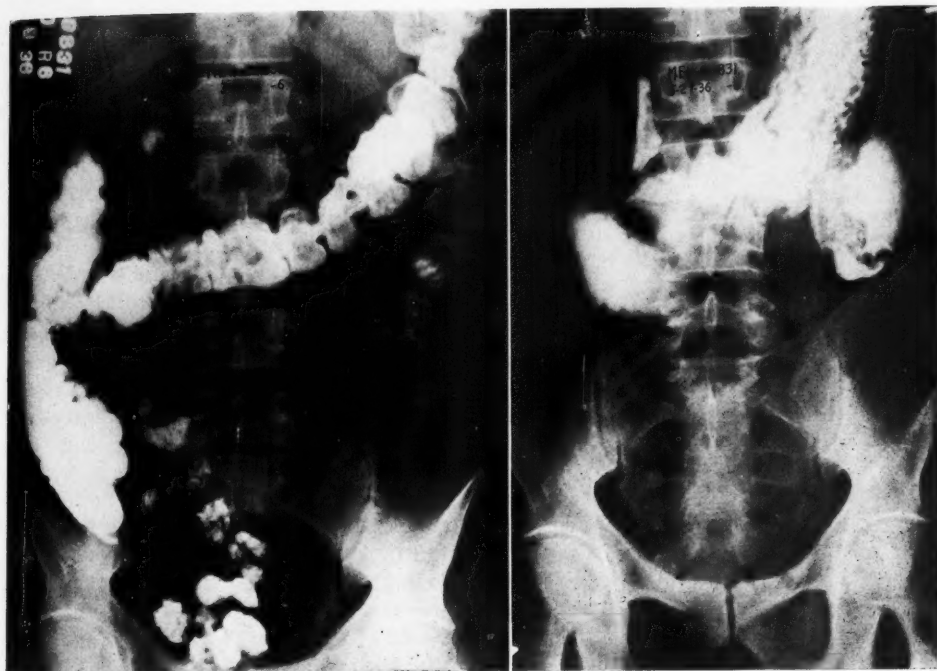


Fig. 2 (left). Case 1. Appearance six hours after barium meal, March 9, 1936.

Fig. 3 (right). Case 1. Retention of barium in stomach and jejunum, six hours after barium meal, May 27, 1936.

meals, unaffected by food or alkalies, and accompanied by occasional nausea and vomiting. Loss of weight, appetite, and strength are quite common. A change in bowel habits with the appearance of diarrhea or constipation, bloody or tarry stools, is also common. Abdominal distention and flatulence are sometimes reported. The acute symptoms—which are sometimes all that the patient ever has, but more often follow a period of indefinite complaints—are ushered in with more frequent to persistent vomiting, cramping abdominal pains that become localized, marked loss in weight, abdominal distention, and constipation or occasionally a bloody diarrhea.

The physical findings in the acute stage are usually those of dehydration, some emaciation, abdominal distention, visible peristalsis, and occasionally a palpable tumor mass. The laboratory findings often indicate a secondary anemia, a depletion in free HCl to complete achlor-

hydria, evidence of dehydration, and the presence of blood in the stool.

The roentgen findings are those of incomplete to complete small bowel obstruction. The stomach and duodenum are usually normal except in those cases in which the carcinoma also involves the duodenum. If the obstruction is high up in the jejunum, there may be considerable dilatation of the duodenum and stomach with reverse peristalsis. There is usually a retardation in the passage of the barium meal through the small bowel, and sometimes complete obstruction with retention of the barium for periods of 24 hours or longer. It is sometimes possible to discern an abrupt demarcation between the involved and uninvolved portions of the bowel and an obliteration of the mucosal relief at the site of the lesion as described by Nettrour (21). The colon is usually normal, but it should always be examined in questionable cases.

The treatment is surgical when the diag-



Fig. 4. Case 1. Stomach practically empty; barium retained in jejunum and small amount in colon, 24 hours after barium meal, May 28, 1936.

nosis has been established. Resection of the tumor mass and anastomosis of the adjoining portions of the bowel is given as the method of choice. In those cases in which resection cannot be carried out, some form of palliative operation for relief of the obstruction is often performed. The prognosis is not good in any event. Rankin (24) reports no cases living over three years. Lynch (15) reports a case known to have lived for six years. Kordenat (14) states that the average length of life is 18 months after operation.

CASE REPORTS

Case 1. D. C., a white male, 39 years of age, was first seen by the author as an outpatient on March 7, 1936. At that time he was complaining of vague abdominal distress, which did not become localized, and was accompanied by occasional nausea and vomiting. He had some diarrhea but not tarry stools. All these symptoms had

started about three months previously except for the diarrhea, which first appeared three weeks after the first pain and vomiting, continued for six weeks, and then stopped. There was never any blood, mucus, or pus in the stool. Roentgen examinations then revealed a poorly functioning gall bladder without stones, a normal stomach, and duodenum with normal motility of the barium through the small bowel at six hours (Figs. 1 and 2), a slightly dilated colon which had normal emptying power, and a visualized appendix which was not tender to palpation.

The patient was next seen after his entry in the hospital May 26, 1937, with complaints of frequent vomiting, loss of weight and strength. The vomiting occurred more and more frequently, and at the time of entry he could retain only soft food. The abdominal pain he had was transient, very slight, and not related to meals. There was no localized abdominal discomfort and no distention. He had lost over 60 pounds in weight during the previous five months. His past history bore no connection to his present illness. There was no history of carcinoma in the family.

Physical examination at this time revealed an emaciated white male with normal heart and lungs, slight distention of the abdomen with some occasional visible peristalsis across the upper part, and palpable inguinal glands. All other findings were essentially normal.

The laboratory examinations revealed: red blood cells, 4,170,000; hemoglobin, 84 per cent; white blood cells, 8,300; urine, essentially normal; phenolsulphonaphthalein test, 64 per cent; blood chlorides, 417 mg.; Wassermann test, negative.

The roentgen examination at this time revealed a normal stomach and duodenum, and a definite delay in motility of the barium through the small bowel. At six hours after the barium meal (Fig. 3) there was a considerable retention in the stomach and jejunum and no barium in the loops of the ileum or the colon. At 24 hours (Fig. 4) the stomach was practically empty, most of the barium was collected in the

left upper quadrant in the jejunum, and a small amount had passed through into the colon. At 32 hours (Fig. 5) the stomach had been partially refilled, by reverse peristalsis, from the barium retained in the jejunum. A diagnosis of almost complete obstruction in the jejunum or upper ileum possibly produced by a tumor, was, therefore, made.

At operation, an annular hard tumor mass was found in the jejunum approximately two feet from the ligament of Treitz. There were multiple firm enlarged lymph glands in the mesentery. There was fixation of the mass to surrounding structures so that it was impossible to resect the tumor. An anastomosis was made around the lesion. One of the glands and a biopsy section of the tumor mass were taken for study. The pathologic report indicated adenocarcinoma of the jejunum with lymphatic metastases. Recovery was slow but uneventful.

This patient was last seen on Dec. 7, 1936. He had no abdominal complaints at this time and had gained 40 pounds in weight. He had a good appetite and no vomiting. Roentgen examination of the upper gastro-intestinal tract revealed a normal stomach and duodenum except for some indentations of the lesser curvature of the duodenum by firm masses which we felt were metastatic nodes (Fig. 6). The motility through the small bowel was normal if not a little rapid, as the stomach and small bowel were empty at the end of three hours (Fig. 7).

This patient died in May, 1937, approximately one year after operation. No autopsy was obtained.

Case 2. M. M., a white female, 60 years of age, was admitted on March 22, 1937, with complaints of vomiting and constipation. The vomiting had started three weeks previous to her entry, had increased in frequency, and although at times bile-stained material was vomited, at no time was there a fecal character to the vomitus. Her appetite was good, but she could retain little or no food. There was no particular pain associated with the



Fig. 5. Case 1. Stomach refilled by reverse peristalsis from barium retained in jejunum, 32 hours after barium meal, May 28, 1936.

vomiting. The constipation had been present for many years but had increased recently. There was no history of bloody or tarry stools obtainable. There had been loss of weight—ten pounds in three weeks.

Physical examination revealed a small elderly female with normal chest findings, some distention of the abdomen, no palpable abdominal masses, and visible peristalsis across the upper abdomen. The other findings were normal. There were no palpable lymph glands.

Laboratory examinations revealed: red blood corpuscles, 4,050,000; hemoglobin, 80 per cent; blood chlorides, 522 mg.; total non-protein nitrogen, 75.8 mg.; Ewald free acid 8, combined 44, lactic acid positive; Wassermann test, negative, and occult blood in stool.

Roentgen examinations revealed a marked dilatation of the stomach without pyloric obstruction and some dilatation of the duodenum to the duodeno-jejunal juncture, at which point there was a definite constriction of the lumen for approxi-



Fig. 6. Case 1. Notching of lesser curvature of the duodenum by metastatic nodules, Dec. 7, 1936.

mately one and one-half inches. There was considerable reverse peristalsis and churning of the barium meal in the duodenum with occasional passage of a small amount beyond the point of obstruction. There was a large retention in the stomach at 24 hours, and not over 20 per cent of the barium passed the obstruction. The colon was essentially normal. A roentgen diagnosis of obstruction at the duodeno-jejunal juncture produced by a carcinoma was made.

At operation a stony hard, annular tumor at the duodeno-jejunal juncture was found, with adjoining masses of enlarged hard lymph glands. The gall bladder was stony hard, white, and fixed in position. It was thought inadvisable to attempt resection of the tumor mass, so biopsy section was made and one of the glands removed, and then a gastro-enterostomy was performed. The surgeon believed the pathology to be a primary carcinoma of the gall bladder with secondary tumor growth about the bowel. The pathologic report indicated a carcinoma originating in the epithelium lining the biliary ducts. Recovery was uneventful, and no further



Fig. 7. Case 1. Appearance three hours after barium meal, Dec. 7, 1936.

reports have been obtainable on the progress of this case.

In summary, the author wishes to emphasize:

1. Carcinoma of the small bowel is not as uncommon as was formerly believed.
2. Patients with indefinite abdominal distress, vomiting which increases in frequency, and occult blood in the stool should be carefully examined for the presence of small bowel malignancy. Examination of the stomach, duodenum, and colon is not enough: too often these are found to be negative and the patient dismissed. Careful, persistent, and repeated examinations of the small bowel are necessary if more accurate diagnoses of these obscure cases are to be obtained.

In addition to the direct references, the author has included in the bibliography many of the recent articles on this subject.

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RECENT ADVANCES IN DIAGNOSIS FROM AND TECHNIC OF CHOLECYSTOGRAPHY¹

By HERMAN B. PHILIPS, M.D., *New York City*

THIRTEEN years have passed since the advent of the Graham test in roentgenology. As is usual with all new diagnostic procedures, it has taken some time to establish its real worth. Considerable stress used to be placed on the intravenous method of examination, but accumulated experience and improvement in technic of the oral method have placed the latter on a par with the intravenous method. Marked impetus was given oral cholecystography about three years ago by the introduction of the so-called "intensifying technic," by Stewart and Illick (1). It combines the methods of Antonucci and Sandstrom, the former by utilizing glucose to aid in more rapid absorption of the iodine by the liver and the latter by using fractional doses of the tetraiodo at more frequent intervals and over a longer period of time.

Credit must be given several roentgenologists for their contributions toward the development of cholecystography and establishing it to-day as a definite, exact method of diagnosis. Among these are Leonard, George, Sosman, Kornblum, Hall, Pendergrass, Hodes, Ettinger, Newcomer, Boyden, McNamee, Moore, Kirklin, Blake, Jenkinson, Stewart, and Illick. The statement is warranted, that the amount of accuracy of information obtainable from cholecystography is directly proportional to the care, precision, and attention to details in the course of the examination. Without these, the results are confusing and the examination of little or no value.

As much attention must be given to the details concerning food ingestion and the administration of the dye as to technic of the examination. We have used the dye in capsule form because we have consistently found that better than other forms of

administration. Patients are given type-written instructions and advised to follow them to the letter. They are as follows:

1. During the afternoon have several cups of tea with excessive amounts of sugar.
2. Have a regular dinner at six o'clock.
3. Take six capsules one hour later.
4. During the evening have two or three cups of tea with excessive amounts of sugar.
5. Have a breakfast consisting of fruit juices and tea with excessive amounts of sugar.
6. Have a luncheon consisting of fruit juices, fruit salad, jello, and tea with sugar.
7. Take six capsules one hour after luncheon.
8. Have the same dinner as luncheon.
9. Take six capsules one hour after dinner.
10. Report for x-ray examination at ten o'clock the following morning without further food or drink.

The initial phase of our examination, after making sure that the patient has followed our instructions to the letter and ascertaining whether there has been any vomiting or diarrhea and the probable influence of same on the success of our examination, is to place the patient in a prone position on the table and make an 8 X 10 roentgenogram of the gall-bladder region. The exposure is a postero-anterior one, centering over a point half way between the middle of the spine and the tip of the last rib. A large cone is used with the Bucky diaphragm. This constitutes a scout film. In the event that the gall bladder is seen, its position relative to the last rib and iliac crest is noted and several films are now made with a small or dental cone, some of them at long distance, some oblique or lateral, some in the Trendelenburg position or erect, in order to bring out all possible fine details of the cholecystogram. This method requires processing and studying each cholecystogram in succession, so as to permit variations in technic to eliminate extrinsic positive and negative shadows and to allow one properly to evaluate

¹ Presented at the Clinical Conferences of the Park East and Park West Hospitals, New York City, during 1937.

intrinsic ones. In the event that no gall bladder is seen, a 14×17 roentgenogram is made to include the entire liver and gastro-intestinal tract. This will show whether or not a left-sided gall bladder is present, and, what is more important, the amount and condition of the dye in the intestine. It may be found that the dye is in its original form, the same as before ingestion, and no cholecystogram can be expected, or there may be heavily precipitated dye, which also is unsatisfactory and only occasionally accompanied by success in the examination. If the dye is found in the intestine in an extremely fine, subdivided, flaky state, and in considerable amounts and the gall bladder does not visualize, it may be considered definitely that a pathologic condition is present in the biliary tract. This determination of the presence of sufficient amounts of dye in a finely subdivided state (as excreted from the liver into the small and large intestine) precludes the necessity for considering systemic disturbance as playing any part in non-visualization. Previously, peritoneal irritation, as from an ulcerative lesion of the gastro-intestinal tract, a severe colitis, hyperthyroidism, extreme asthenic states, pregnancy, severe cardiac failure with passive congestion, ulcerative lesions of the stomach or duodenum, and diabetes were considered as influencing the cholecystographic examination and as being responsible for non-visualization. Since the introduction of the special intensifying technic, most of these fail to interfere with satisfactory cholecystography and the only real deterring factors are those of a mechanical character, such as obstruction of the pylorus or duodenum, so that the dye cannot be carried into the small intestine to be absorbed, or an intense diarrhea with too rapid evacuation of the dye with prevention of absorption in sufficient amounts.

The examination after a motor meal is extremely important and merits special comment. Roentgenograms are made one-half hour and one and one-half hours after the meal is ingested. The gall bladder

should be partially contracted and emptied. It is at this stage of the examination that adenomas are most frequently visualized. The same obtains for some opaque and non-opaque calculi, either casting only suspicious shadows or none at all, in the roentgenograms made prior to the motor meal. If the gall bladder emptying is retarded, another roentgenogram is made after another hour and occasionally after twenty-four hours, in cases in which extreme delay of emptying is noted.

A few years ago the opinion was quite prevalent that if a gall bladder did not visualize it was not necessary to continue the examination with a motor meal and further roentgenograms. We have encountered at least five cases in which a motor meal served to fill the gall bladder with dye with good concentration, in which it previously was not seen. This phenomenon has been explained on a mechanical basis by Newcomer and Newcomer (2), who have shown that there may be a natural kink or twist in the cystic duct which is straightened out by tension on or pressure by the pylorus when the pylorus is filled with food, permitting the dye to go into the gall bladder. These authors also claim emptying of the gall bladder solely on a mechanical basis, that fatty foods are not essential to empty the gall bladder, but that compression of the gall bladder by the active peristaltic pylorus after food ingestion is responsible for emptying. It is, therefore, indispensable in all cholecystographic examinations to include at least one roentgenogram after a motor meal. If all of the above details have been considered and provided for in the examination, it is justifiable to assume that non-visualization of a gall bladder indicates a pathologic condition of the liver, bile ducts, or gall bladder, which either prevents excretion of the dye, transmission of the dye, or storage of the dye, respectively. According to Hodges and Lampe (3), there is 80 per cent accuracy of the conclusions based on non-visualization, as checked by operation.

Non-visualization of the gall bladder



Fig. 1 (*left*). Gall bladder not visualized by "intensified" technic (Aug. 31, 1934). (*Right*). Cholecystogram with good concentration, normal contour, no calculi, after three months of "medical" treatment for a chronic cholecystitis (Dec. 3, 1934). This case illustrates the need for conservative estimate of non-visualization, value of conservative treatment, and serial studies.

should not be accepted as an absolute indication for surgical intervention, for a transitory inflammatory condition may be present and cause sufficient obstruction of the cystic duct to prevent the dye entering the gall bladder. This may subside rapidly under conservative medical therapy. Unless the symptoms are very severe or calculi are demonstrated, conservative treatment, followed by another cholecystographic examination, may show a fairly normal cholecystogram subsequently (Fig. 1). This point was stressed emphatically by Jenkinson (4) in September, 1936, and if followed, the small percentage of errors will be still further diminished.

Occasionally gas or dye shadows in the colon overlap the cholecystogram, resulting in very confusing shadows. To remove them, it has been recommended that pitressin be used hypodermically. We have not been convinced that this is valuable, but do find that the simple procedure of administering a high hot enema eliminates all gas and dye shadows in the colon

and permits of a much more satisfactory continuation of the examination.

In the interpretation of positive and negative shadows in the roentgenograms, suspicious of gallstones, one must make use of technical variations including changes in position of the patient. Lateral and oblique roentgenograms serve to eliminate persistent confusing gas shadows which sometimes cannot be differentiated from the negative shadows of pure cholesterol calculi. Variations in position of the patient are also indispensable in differentiating positive shadow calculi from congenital malformations of the gall bladder ("Phrygian caps" and pseudo-diverticula), some of which cannot be differentiated from calculi by any other method. Erect and Trendelenburg roentgenograms are useful in differentiating negative shadow calculi from papillomas, adenomas, or other tumors, in which case calculi can be made to move around in the gall bladder, while the tumors will remain in a fixed relative position. The erect roentgenogram is

essential in demonstrating very small, radiolucent cholesterol calculi, not seen in routine horizontal exposures.

THE NORMAL

Before considering the pathologic, it is essential to consider what the normal findings are in a cholecystographic series. The gall bladder may show up clearly by means of the intensified technic with a density as great as, or greater than, that of the adjoining bony structures, and frequently equalling that found in the hollow viscera in the course of an opaque meal examination. Kirklin and Blake (5) have stressed the importance of judging the cholecystogram by its best appearance and considering it normal unless the shadow is so delicate that its borders can be traced only with difficulty. The gall bladder should be homogeneous in density and smooth in contour. The position varies with the type of patient and follows, with occasional exceptions, the general rules of habitus that obtain for the position of the stomach and intestines. In the course of a routine examination, roentgenograms should be made one-half hour and one and one-half to two hours after the ingestion of a motor meal, our motor meal for the last few years comprising two eggs and one-quarter of a glass of cream with anything else that the patient chooses to take. The post-motor meal roentgenograms should show definite evidence of contracture of the gall bladder with diminished size of the gall bladder, but no evidence of irregularities in contour or density. The roentgenogram made thirty minutes after the motor meal may show the cystic duct, but this lack of visualization of the cystic duct should not be regarded as an indication of a pathologic condition. If information about the cystic and common ducts is desired, the routine may be altered so as to have the patient in the supine position, an anteroposterior roentgenogram being made instead of the usual postero-anterior one in the prone position. This frequently facilitates filling of the cystic and common ducts. The one and one-half

hour roentgenogram should show more complete emptying and contracture of the gall bladder. At least two roentgenograms should be made following the motor meal, preferably at the time-interval outlined above. If the gall bladder does not empty, further examinations should be made after twenty-four hours.

PATHOLOGIC GALL BLADDER

The pathologic gall bladder varies from complete non-visualization to very faint visualization. If persistent roentgenographic examination with the most careful technic and diaphragming, following the plan outlined in the introductory remarks, fails to reveal a gall bladder with sufficient clearness to permit of a definite outline, some abnormality must be considered to exist. A large gall bladder must be regarded as pathologic. Irregular calcification of the costal cartilages are frequently a source of error in interpreting the border of gall bladders, as well as confusing in the interpretation of stones within the gall bladder. Oblique and lateral roentgenograms will definitely exclude these shadows and determine their actual character. A new nomenclature was suggested by Pendergrass and Hodes (6) in 1935, based on apparent functional capacity. They enumerate three general classes. The classification has met with general approval for it lends itself to a most conservative and accurate estimate of the gall-bladder condition. It is as follows:

Gall bladder maintains some function, no matter how diseased it may be.

I. "Functioning gall bladder."

- (a) "Functioning gall bladder with stones."
- (b) "Functioning gall bladder with mural growth (papilloma)."
- (c) "Functioning gall bladder with adhesions."
- (d) "Functioning gall bladder with anomalies."

II. "Partially functioning gall bladder."

- (a) "Partially functioning gall bladder with stones."
- (b) "Partially functioning gall bladder with anomalies."



Fig. 2. "Negative shadow" calculi are easily confused with air shadows in superimposed colon. Positive differentiation by oblique and lateral roentgenograms.

(Upper left). Negative and positive shadow calculi, persistent at all angles.

(Upper right). Three or more "negative shadow" calculi present in lateral and oblique roentgenograms.

(Lower left). Lateral roentgenogram shows persistent "negative shadow" calculus, other confusing negative shadows being eliminated.

(Lower right). Extrinsic negative shadow from hepatic flexure, eliminated by lateral roentgenogram.

III. "Abnormally functioning gall bladder."

(a) "Abnormally functioning gall bladder with stones."

(b) "Abnormally functioning gall bladder with anomalies."

(c) "Calcified gall bladder."



Fig. 3. Intra-hepatic gall bladders (two cases). Dotted lines show lower borders of liver. Gall bladders are transversely placed. (See text.)

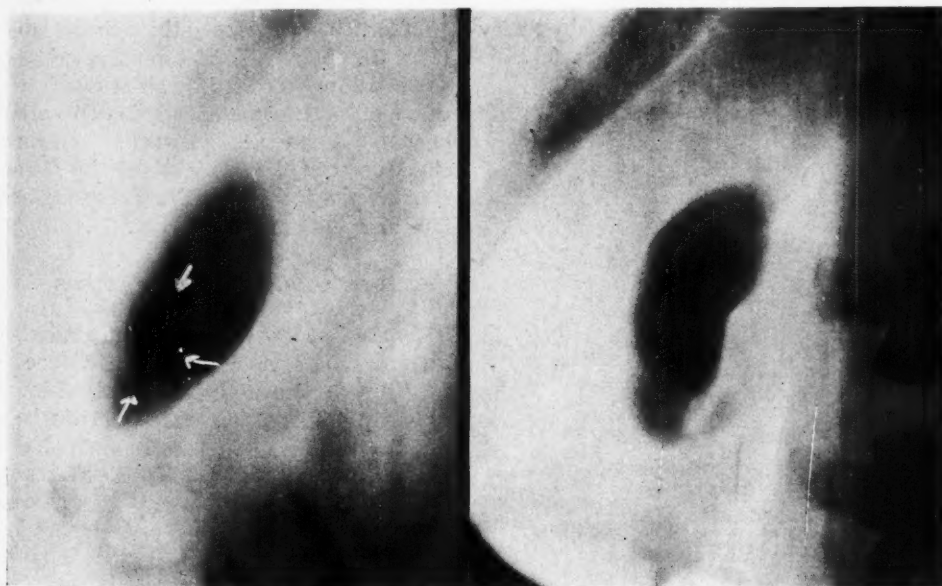


Fig. 4. "Phrygian cap" gall bladder at different angles, showing the constriction and deformity of the fundus, producing a pseudo-diverticulum, seen in profile on the right, whereas on the left the diverticulum is overlapped by the rest of the gall bladder and produces a shadow, indistinguishable from a "positive shadow" calculus.

CHOLELITHIASIS

The accuracy of the diagnosis of calculi hinges mostly on refinements in technic

and is directly proportional to the precision and thoroughness of the examination. The most valuable of these is the liberal

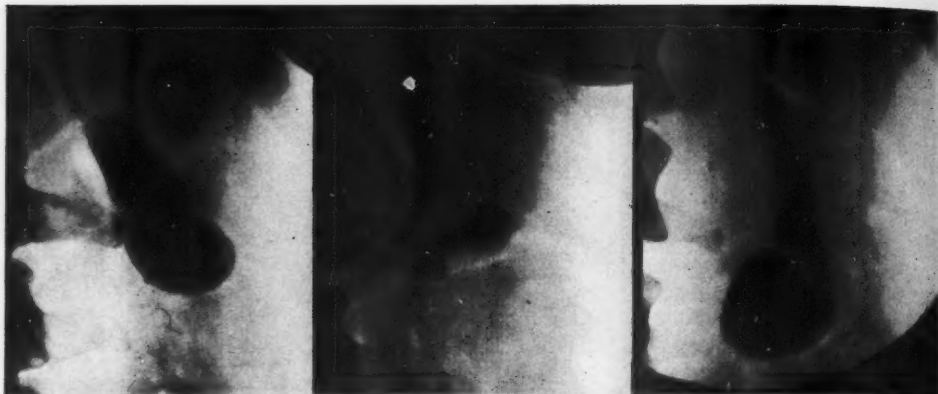


Fig. 5. Other cases of "Phrygian cap" gall bladders, showing the marked deformities easily misinterpreted by those unfamiliar with the anomaly.

utilization of examination of the patient in the lateral, oblique, and erect, and occasionally in the Trendelenburg positions, particularly during the post-motor meal period. In the latter, either by deposition of the dye on the surface of radiolucent gallstones or by the elimination of part of the dense superimposed opacity of the dye-containing bile, it is feasible

to definitely demonstrate calculi with considerable certainty. There should be exceedingly little room for doubt in a dye series, if all these details in technic and procedure are carried out to the letter. Occasionally two calculi—a positive and a negative shadow—are seen in the same gall bladder, the former seen through the latter (Fig. 2). Most of the confusing negative shadows are produced by air or dye in the colon, but if these are not eliminated by a hot enema, the exact character of these shadows can be determined in almost every instance by utilizing oblique and lateral roentgenograms (Fig. 2).

INTRA-HEPATIC GALL BLADDERS

In the last few years, I have found what appear to be roentgenologically (unconfirmed by operation), three cases of intra-hepatic gall bladders. These have been situated transversely with the gall bladder, more or less embedded in the liver substance (Fig. 3). They may present considerably above the liver border, appearing like cysts, or they may show only as dimples on the undersurface or along the lower border of the liver. McNamee (7) reported two cases of intra-hepatic gall bladder. In one, the organ could not be found at laparotomy for it was completely buried in the liver substance. However, it was visualized again in a second Graham

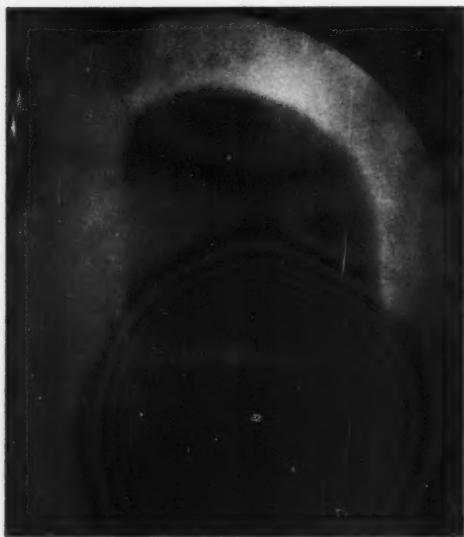


Fig. 6. Erect cholecystogram to demonstrate minute cholesterol calculi which float between biles of different concentrations, at their interfaces. (Reproduced through courtesy of Dr. Alice Ettinger and the "American Journal of Roentgenology and Radium Therapy.")

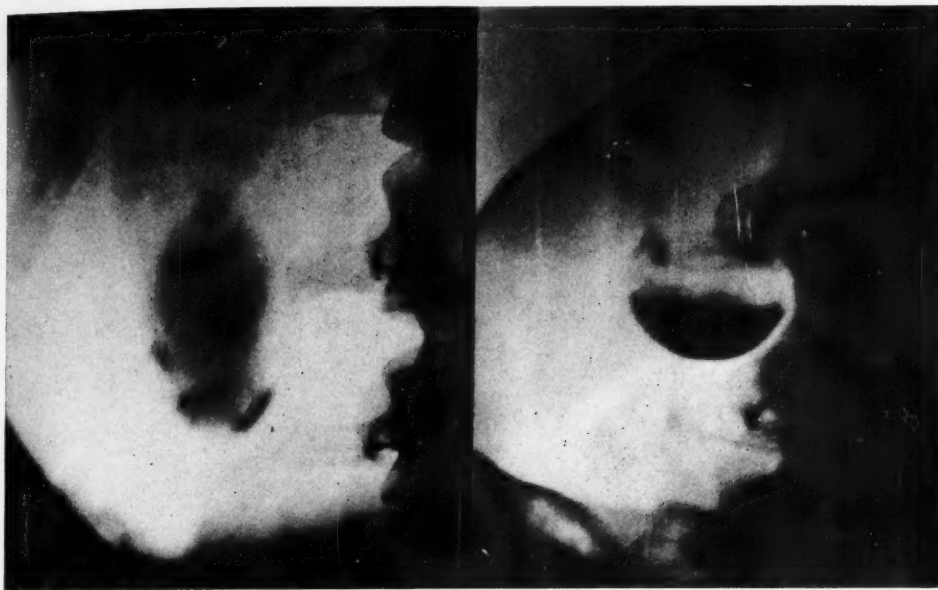


Fig. 7. Milk of calcium bile gall bladder. (Left). Prone. (Right). Erect, showing fluid opaque bile. Calculi in cystic duct clearly seen in three other cases. Gall bladders usually small and contracted. Any blotchy opaque shadow encountered in the upper right quadrant, without dye series, should be examined in the erect position to exclude milk of calcium bile gall bladder.

test. The pre-operative information that the gall bladder is all or partially buried in the liver substance should be of inestimable help to the surgeon.

"PHRYGIAN CAP" GALL BLADDERS

Irregularities in contour of the gall bladder, until a few years ago, were considered, almost uniformly, as being caused by deforming gall-bladder adhesions. An illuminating article on this subject by Boyden (8) throws considerable light on these defects, and it is a safe statement to make that most of the irregularities in a gall bladder that is not markedly contracted or poorly visualized, are due to congenital anomalies of development. In Boyden's experience 18 per cent of cholecystograms showed "Phrygian caps." There are two groups, the concealed (or retroserral type) and the serosal type. In the latter, which is the more common type, the deformity is fixed by fetal ligaments or constrictions of the lumen, the peri-

toneum following the folds in the gall bladder. In our experience, when the deformity is marked it lends itself to confusion, and exposures from several angles are essential to clarify the diagnosis. The pouching of the fundus may produce pseudo-diverticula, and in one instance the overlapping of a diverticulum by the gall bladder gave a shadow indistinguishable from a positive calculus (Fig. 4). There is no particular clinical significance to these anomalies. They are not associated with any symptoms; they show no roentgenological or other indications of disturbance in function (Fig. 5).

THE ERECT CHOLECYSTOGRAM

All cholecystographic examinations should include at least one roentgenogram made in the erect position. While this procedure has been stressed earlier in the paper under technical considerations, elaboration is essential to emphasize its importance in the detection of minute calculi.

as described by Ettinger (9). She reports three cases in which small concretions, not otherwise demonstrable, were detected

MILK OF CALCIUM BILE GALL BLADDER

Knowledge of new concepts of pathologic entities focuses attention on such condi-



Fig. 8. Gall bladder with calcified walls.

floating at a certain level within the bile. They are small cholesterin stones which float between biles of different concentrations at their interfaces. Through the courtesy of this author and the "American Journal of Roentgenology and Radium Therapy," one of the author's unmatched illustrations is reproduced herewith (Fig. 6).

tions, with frequent surprises due to encountering them with fairly high incidence. This is true of the writer's experience with milk of calcium bile gall bladders. Although my personal experience with this condition has been quite limited. I recall seeing several of these cases in the past, yet did not recognize them as clinical entities. After reading the comprehensive descrip-

tion of this condition by Kornblum and Hall (10) in May, 1935, I encountered four cases in the following year, only two of them in the course of gastro-intestinal studies (Fig. 7). The condition is one of obstruction of the cystic duct, usually by calculi, with stasis of diseased bile in a contracted gall bladder over a long period of time, with precipitation from the mucus of the walls of the diseased gall bladder of calcium carbonate, which renders the bile opaque. Usually some freely movable opaque bile is found, which will show a fluid level in the roentgenograms taken in the erect position. In all four cases there were several calculi apparently impacted in the cystic duct. These gall bladders are always small, the condition occurring only in small, chronically contracted gall bladders. These have to be differentiated from calcific deposits in the gall-bladder walls (Fig. 8). In these cases, there is no alteration in shape or density with change from horizontal to erect position, there being no opaque bile in these gall bladders. Kornblum and Hall stress the following characteristic features of the condition:

- (A) Suspect when gall bladder visualized without cholecystography.
- (B) There is no change in the appearance after fatty meal.
- (C) Persistence of gall-bladder shadow after cholecystography.
- (D) Persistence of stones in the cystic duct with visualized gall bladder.
- (E) Shadows unlike gallstones found in

association with a non-visualized gall bladder during cholecystography.

SUMMARY

Technical considerations are outlined which afford maximum accuracy in cholecystography.

The differential features of normal and pathologic gall bladders with or without calculi are described.

The following conditions, now easily demonstrated by recent advances in cholecystography, are illustrated and briefly described, with differential diagnostic features: (1) the normal gall bladder; (2) pathologic gall bladders; (3) cholelithiasis; (4) intra-hepatic gall bladder; (5) "Phrygian cap" gall bladder; (6) milk of calcium bile gall bladder.

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THE RETENTION OF THORIUM DIOXIDE BY THE RETICULO-ENDOTHELIAL SYSTEM

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From the Department of Roentgenology of Duke Hospital

SINCE thorium dioxide solution was first used clinically by Radt (1), little has been learned about its rate of elimination from the body. We have been able to determine by roentgenograms that the liver and spleen retain some qualitatively large portion of the compound, but it is most logical that the radio-activity of the thorium series, which has engendered much of the prevalent suspicion of its physiological effects, should be chosen as an indicator for actual measurement of retention by the organism.

The Geiger-Müller counter offers a sufficiently sensitive, simple, and rapid method for measuring such small intensities of radiation directly from the patient. Experimental work was, therefore, undertaken with this type of instrument to determine the average retention of intravenously administered thorium dioxide in the human organism.

The absolute intensity of gamma radiation from fresh commercial thorotrast has been determined, in the course of our preliminary calibrations, to be equivalent to approximately 1.9×10^{-8} grams of radium per cubic centimeter. The factor is also substantiated by the recent work of Taft (2), whose measurements indicate a value of about 1.8×10^{-8} .

Although the radio-active life of thorium in equilibrium with its decay products is far too great to be a perceptible factor in a clinical investigation, it has been shown that thorium dioxide as prepared commercially from thorium nitrate originally includes none of the decay series except radiothorium. From this beginning, the decay of the relatively short-lived radiothorium together with the natural production of mesothorium will combine to cause a fairly rapid change in the alpha-ray activity of the sample. According to

the calculations of Schlundt¹ and others, the alpha radiation from a given sample of freshly prepared ThO_2 decreases by about half during the first five years, then gradually increases over a period of approximately thirty years to its original value.

During this time, the gamma radiation, however, undergoes a much smaller variation. This gamma radiation, being the only portion which can penetrate through the abdominal wall, will of course constitute the portion measurable by external apparatus. Unfortunately, complete parallel history of the gamma-ray activity of thorium dioxide solution *in vitro* was not possible, since the data herewith submitted include patients who received thorium injections two or three years before the beginning of the experiment. During the few months over which actual measurements have been taken, original ampules of the thorium solution have maintained their gamma-ray activity constant within the experimental errors of the original reading. Since the inherent difficulty of such work with living patients precludes any high degree of accuracy, we have for the sake of simplicity assumed the gamma-ray intensity of ThO_2 to be approximately constant over the four-year period covered by these data.

The next point of importance, then, is the establishment of some experimental basis for estimating the quantity of thorium retained by the patient after the useful, or diagnostic, service of the drug has been rendered. This is the purpose of the present work. The experimental results have been expressed as retention per cent (Table I), which values are arbitrarily

¹ Communication by courtesy of Heyden Chemical Corporation.

based on the maximum concentration observed rather than on any absolute numerical scale. Points on the curve (Fig. 1)

tion must necessarily introduce errors into the measurements. The data, therefore, are presented only as a summary of aver-

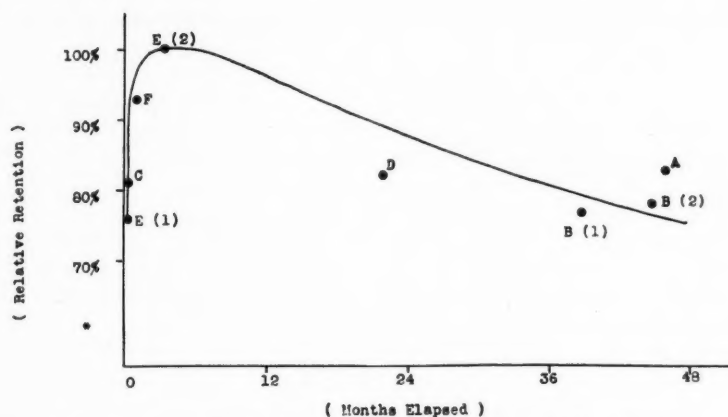


Fig. 1. The retention of thorium dioxide by the reticulo-endothelial system.

represent gamma-ray intensities relative to this maximum.

The apparatus employed in securing the clinical data was the "Gamma-ray Detector," previously described (3), with the addition of a watch-type integrating recorder (4), and an accurate automatic voltage regulator (5). The patients observed were routine diagnostic cases, taken at more or less random intervals after injection. It is obvious that individual variations in size and position of liver, thickness of abdominal walls, or slight differences in location of the Geiger counter relative to the patient under observa-

age conditions. The accuracy possible with successive readings on the same patient, a few minutes apart, has been found to be of the order of a few per cent.

The shape of the composite retention curve (Fig. 1) indicates, in agreement with radiographic data, that a period of several days is required for the thorium to reach its maximum concentration in the region of the liver. In the course of subsequent readings, the observed radio-activity is found to decrease very gradually to approximately 80 per cent of this maximum value. Data now available do not extend beyond four years' history, but we

TABLE I

Patient	Date Injected	Date Checked	Time Elapsed	Total Count per Minute	Background per Minute	Thorium Count per Minute	Retention Percentage
A	12/1/32	9/9/36	46 months	15.0	5.8	9.2	83
B (1)	8/16/33	11/17/36	39 months	14.2	5.7	8.5	77
B (2)	8/16/33	5/12/37	45 months	14.5	5.8	8.7	78
C	11/17/36	11/28/36	0.25 month	14.7	5.7	9.0	81
D	11/28/34	9/2/36	22 months	14.6	5.5	9.1	82
E (1)	7/8/36	7/14/36	0.25 month	14.1	5.7	8.4	76
E (2)	7/8/36	10/27/36	3.5 months	16.8	5.7	11.1	100*
F	4/20/37	5/21/37	1 month	15.9	5.6	10.3	98

* The rate of concentration and subsequent elimination by the reticulo-endothelial system is shown on the graph of Figure 1.

can assume from the general trend of the curve that the decrement beyond this time will be correspondingly slow. It certainly seems safe to predict that the patient is likely to retain a considerable portion of the injected thorium throughout life.

Although the actual quantity of radiation measured in these experiments is exceedingly minute, it must be remembered that only gamma rays are being recorded. Both of the corpuscular components of the general radiation are absorbed by intervening tissue, before reaching the apparatus.

As to the degree in which the continued presence of thorium compounds might eventually prove injurious to the organism, we prefer to reserve judgment until more

complete pathologic data are accumulated on the long-term effects of such relatively small quantities of alpha and beta particles. Such data are, apparently, not complete in the literature at present.

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NEW DISPLACEMENT TECHNIC FOR STUDY OF GASTRIC MUCOSAL RELIEF

I. PRELIMINARY REPORT

By A. E. COLCHER, M.D., Philadelphia

CAREFUL analysis of existing contributions often reveals that which we consider original is merely an adaptation, revival, or refinement of previous labors. In fact, completely original departure in our state of organized knowledge is highly improbable. This study of the mucosal folds of the stomach is presented as an adaptation and revival of a known technic.

It is a surprising fact, not superficially recognized, that the x-ray examination of the stomach still escapes absolute recognition of criteria which should make diagnosis a relatively simple matter, although the stomach was one of the first internal organs to be visualized by artificial ingestion and one which has received a major amount of attention.

The recognition of early carcinoma of the stomach has become progressively more difficult and baffling. This is not the result of lack of interest in the stomach, because the literature shows an increasing number of articles directed to it. However, if we are to make an early diagnosis of any lesion of the stomach, particularly carcinoma, it is imperative that minute studies of the mucosal relief should be made. It follows, therefore, that newer methods should be employed in order to emphasize the finer mucosal markings to such a degree that the rugal folds can actually be studied with a magnifying glass to effect macroscopic visibility for evidences of morphologic changes.

To this end, as early as the turn of the century, Einhorn employed a blower with bismuth powder to coat the stomach, and Holzknecht and Brauner used gas distention with tartaric acid and sodium bicarbonate. Later, various methods of palpation and allowing the bismuth to settle out of suspension (1) were used to demonstrate the mucosal folds. In 1911

the method of inflating the stomach with air was used (2) in combination with a contrasting emulsion. Akerlund (3) used external pressure over the duodenal bulb, displacing all but a thin layer of the opaque solution. In this way rapid progress was being made in the visualization of the mucosal folds.

In 1923 a significant point of departure was established by Forssell (4), who drew attention to the mucosal movements independent of peristalsis. This constituted one of the first deliberate attempts to focus attention on the rugæ *per se*. This contribution to the anatomy of the mucosal membrane of the stomach by means of anatomical pressure succeeded in demonstrating the coil-like rugal folds on the anterior portion of the stomach and the less frequent longitudinal folds of the posterior wall. The remainder of the mucous membrane on the posterior wall was found to be contracted through the building up of a mammillated surface, the so-called "état mammelonné" (Fig. 1). Forssell's studies indicated that the mucous membrane could produce a folding and contraction independent of the peristaltic waves.

Various other methods were also used (5, 6, 7, 8, 9), and investigators realized that the mere study of the stomach silhouette was not sufficient and that the visualization of the mucosal relief markings was an important factor for the diagnosis of various lesions of the stomach.

In 1927 Hilpert (7) used thirty grams of barium sulphate with about fifteen grams of bolus alba and introduced from 300 to 500 c.c. of air to further the study of the mucosal relief markings. Inflation with this large amount of air tended to iron out the mucosal folds, but it was a definite step toward pneumo-relief of the gastric mucosa. Chaoul (10) employed pressure through a rubber bag strapped in position



Courtesy Am. Jour. Roentgenol. and Rad. Ther.

Fig. 1. The mucous membrane of a normal stomach (4).

by means of a leather belt under fluoroscopic control on a table similar to that used by Cole. The pressure technic (1, 9, 11) then came into more prominence.

Regelsberger (13) employed umbrathor, a colloidal thorium dioxide, along with careful inflation, but this heavier metal was found to cause undesirable conditions such as clotting and formation of droplets. He pointed out, however, that were this technic successful, roentgenology would have a definite means of mucous membrane representation, with the possibility that the state of acidity based upon the structure of the markings could be judged. McKee (14) recently demonstrated ulcers in two cases with the gas-filled stomach alone. Poppel (15) used barium NaCO_2 and vichy water, while Arens and Mesirow (16) made use of rugar and Seidlitz powders.

It must be admitted that in cases in which pressure was applied there has naturally been a certain amount of distortion, but in the main this method has offered many excellent contributions to the field of diagnosis.

We thus see that until now the pressure technic has commanded most of our atten-

tion and the intubation of air has been more or less neglected. In summing up the methods used directly to outline the mucosal folds, one realizes that too much inflation, or uncontrolled inflation, as well as too much pressure, may cause distortion. A technic which would properly incorporate both air and an opaque medium, and which would produce minimum distortion and be simple in execution, would therefore be desirable. To this end it occurred that the employment of a slightly greater amount than a minimum of barium and a lesser amount than a maximum of air could be utilized so as not to disturb the mucosal markings of the stomach. This might be supplemented by the utilization of radical changes in the position of the patient, so that the air and barium could be alternately displaced, and various portions of the stomach demonstrated in turn. This led to the adoption of the following technic.

METHOD OF PROCEDURE

The patient having been instructed to present himself without breakfast is then intubated, and, with the end of the tube in the fundus of the stomach, about 50-100 c.c. of air are injected, depending upon the size of the stomach. Thus a moderate sized gas bubble is created. The patient is then given about four to six ounces of standard water barium meal. The usual roentgenographic and fluoroscopic studies are made in the erect posture. In the next step of the process we employ an adaptable fluoroscope, wherein a head and shoulder rest is used and foot straps are applied over the insteps. In this manner the patient can be kept in position with the least discomfort and can be rocked from a vertical position down to a Trendelenburg position of not less than forty-five degrees. Thus when the patient is placed in the Trendelenburg posture the air displaces the barium at the pylorus and the barium meal displaces the air at the fundus. With these moderate amounts of barium and air, and change of the position of the patient, both the upper and lower stomach may be studied separately. In rotating

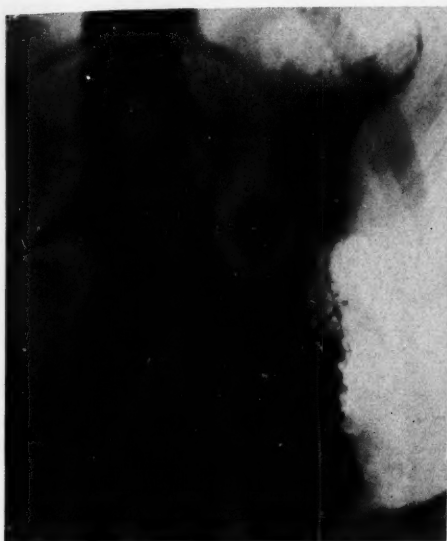


Fig. 2-A.

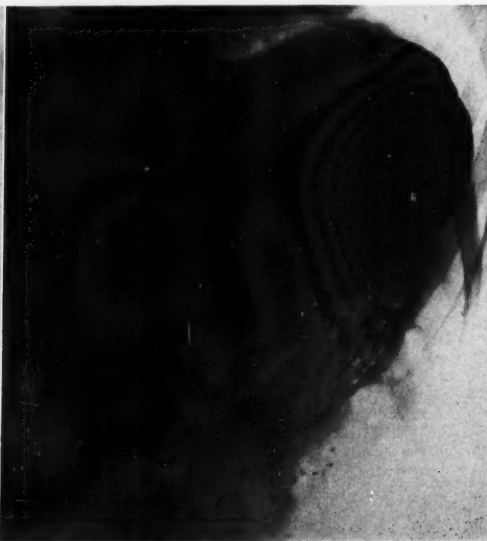


Fig. 2-B.

Fig. 2. The normal stomach. (A) Upright position. (B) Trendelenburg position showing the normal mucosal markings both in the proximal and distal portions of the stomach.

the patient to the Trendelenburg posture, he is allowed to rest in the horizontal position for a minimum of fifteen minutes, to allow for dilution of gastric secretion and certain amount of cohesion of the barium to the stomach mucosa. A simple analogy in this respect would be a sealed milk bottle half filled. When the bottle is inverted the portion occupied by the fluid is displaced by air and a residual thin film of coating is left which takes several minutes to drain. The patient is filmed during this draining period. It is found that the barium becomes deposited in the rugal folds so that the markings are finely differentiated. The displacement process may be repeated under fluoroscopic control, and films taken with the tube under the table and the plate placed on the patient's abdomen. In this manner films are obtained showing the very fine mucosal markings which stand out in bold relief—their texture is so fine that frequently one must use a magnifying glass to observe their detail. Occasionally there is a normal gas bubble of sufficient size to carry out the study without the necessity of intubation.

Since the quantity of air intubated and

the amount of barium is dependent upon the size of the stomach and upon the patient's comfort, the problem of belching and untoward complications is eliminated.

The ordinary fluoroscope is not easily adaptable. With the old standard type and with shock-proof cable and tube the radical changes in position can be accomplished easily and efficiently.

One is cognizant of the fact that there never may be any one method of absolute standard procedure, but an attempt is made by this means to validate certain diagnostic criteria and effect a refinement in procedure which is easily applied. We believe that this technic accomplishes all of these aims.

Case 1 (Fig. 2). E. D., 16 years of age, white, female, was referred with a history of pain in the epigastrium; bloating and nausea; marked constipation. The appetite was good. In this case 60 c.c. of air and 6 ounces of barium sulphate were intubated. The roentgen examination revealed a spastic colon with prolonged retention of the barium meal. No pathology was present.

Figure 2-A, taken in the upright posi-

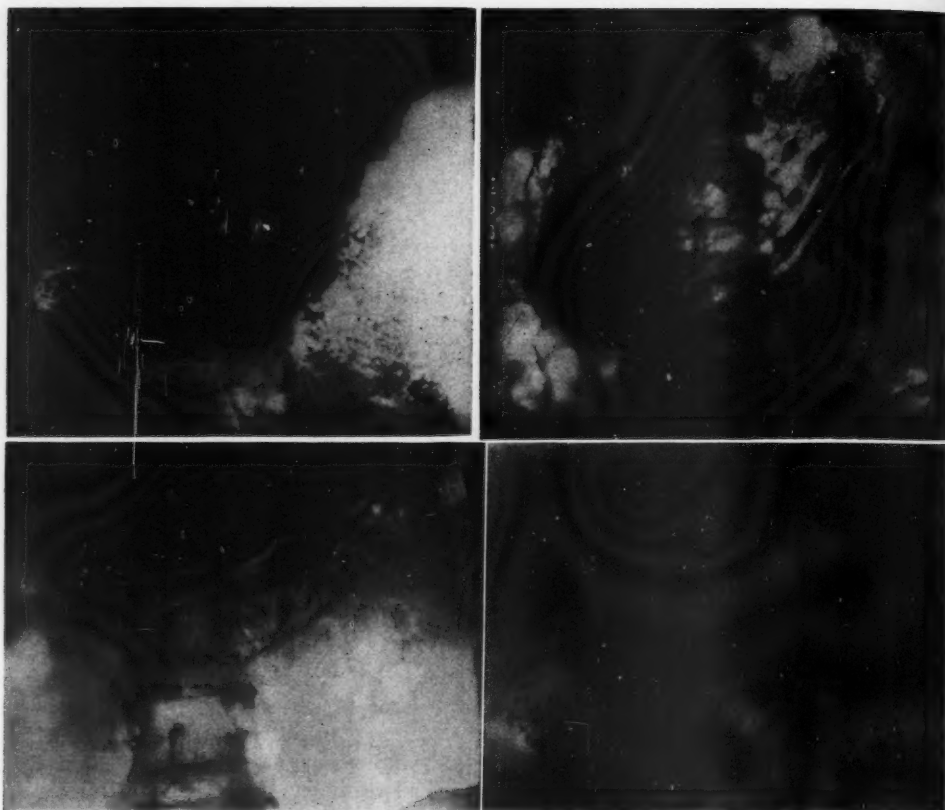


Fig. 3. Chronic hypertrophic gastritis. (A, upper left). Erect. (B, upper right). Prone. (C, lower left). Supine. (D, lower right). Trendelenburg. Note hypertrophied rugae without scalloped margins.

tion, shows the normal longitudinal rugal folds with the scalloped margins on the greater curvature. The upper part of the stomach is ballooned out down to about the sulcus angularis.

Figure 2-B was taken in the Trendelenburg position at about 55° . Note the replacement of the air in the antrum and pylorus without distention or ironing out of the mucosal markings. One may discern the clear-cut margins caused by the barium coating together with the prominent longitudinal folds on the anterior wall and the lesser longitudinal folds, with the mammillated appearance on the posterior wall as described by Forssell.

Case 2 (Fig. 3). R. S., female, 38 years of age, for ten years had complained of epigastric pain radiating to the back. The

pain was not related to the ingestion of food. The previous diagnoses had been periduodenitis and duodenal ulcer.

Gastric analysis showed increased free and total acidity; no blood in any of the specimens. Studies were made with intubation of 75 c.c. of air and 5 ounces of barium water. Exposures were made in the erect, prone, supine, and Trendelenburg 45° positions.

One can see the clear-cut marginal outlines and exaggerated longitudinal folds, both on the anterior and posterior walls. A striking feature is the absence of the scalloped appearance of the margins which has been considered evidence of hypertrophied rugae. This would indicate that scalloped margins are not always present in hypertrophy.



Fig. 4-A.



Fig. 4-B.

Fig. 4. Diagnosis: scirrhus carcinoma. (A) Upright. (B) Trendelenburg. Note finely meshed, honey-combed appearance of tumor.

Following is the report of the gastroscopic study made by Dr. Gabriel Tucker:

"The esophagus was negative.

"Examination of the stomach showed some thickening and increase in size of the rugal folds. The appearance was suggestive of a chronic hypertrophic gastritis. There were some features of the examination, however, that were unsuccessful because of the fact that the patient expelled the air from the stomach as rapidly as it was inflated. The pylorus was not satisfactorily examined."

Case 3 (Fig. 4). S. P. F., 64 years of age, white, male, referred for "intestinal grippe" which had been present for six months. For the last seven weeks the patient had complained of loss of appetite, nausea, belching, with loss of 15 pounds in weight.

Exposures were made with intubation of 50 c.c. of air and 4 ounces of barium water in the upright (a) and Trendelenburg (b) positions. Diagnosis: Scirrhus carcinoma, confirmed by operation and biopsy. Operation by Dr. Williams, Abington Hospital.

Although the diagnosis could have been made from the ordinary films, the use of

the present technic allows us literally to visualize the morphologic changes. This may be of importance in helping to decide the advisability of operation in any particular case. It is also possible that various pathologic conditions may present different structural markings. Here the tumor shows a finely meshed, honey-combed appearance.

Case 4 (Fig. 5). J. L., white, male, 28 years of age. Symptoms: Chiefly neurologic tic, which had been present for two and a half years. Gastro-intestinal studies were made as part of a general examination. The patient had recently lost 14 pounds in weight. A film was taken with intubation of 60 c.c. of air and 5 ounces of barium in the Trendelenburg position: no pathology was found. The film is published in order to show the clear outline of the distal duodenum, which is ordinarily blotted out by the barium meal, while here it is silhouetted by the air in the stomach. Note that the scalloped margins are present, but that there are no hypertrophied rugæ.

Case 5 (Fig. 6). R. L. S., white, male,



Fig. 5. Normal stomach with distal duodenum visualized through double contrast media.

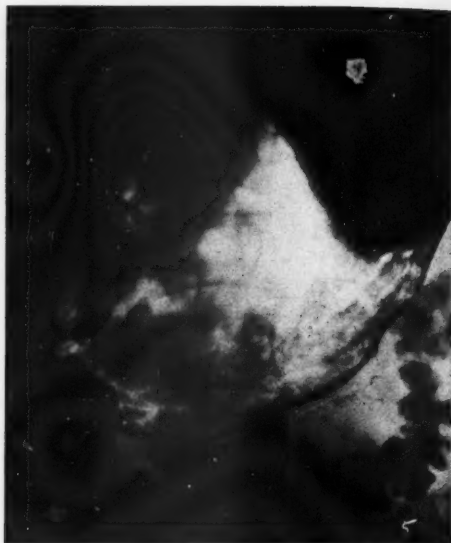


Fig. 6. Trendelenburg position. Normal mucosal markings obscured by presence of large amount of mucus.

30 years of age. Pain in the epigastrium with gnawing sensation for many years; no gas or belching; no relation of symptoms to meals. The patient was generally weak and nervous.

Gastric analysis: Normal, free and total HCl; large amount of mucus. Intubation of 75 c.c. of air with 6 ounces of barium.

Here we note the obscuration of the mucosal markings as a result of the presence of mucus.

A greater number of cases are being studied at present. This preliminary report is presented so that other investigators may employ the technic and discover possible disadvantages or suggest constructive modifications, and by such contribution advance our skill in early and differential diagnosis of diseases of the stomach.

Spruce Street Medical Building

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SOME LAWSUITS I HAVE MET AND SOME OF THE LESSONS TO BE LEARNED FROM THEM¹

(Second Series, Fourth Installment)

By I. S. TROSTLER, M.D., F.A.C.R., F.A.C.P., Chicago

MY OWN MALPRACTICE SUIT (THERE WAS NO
LIABILITY AND THE STATUTORY LIMITATION
HAD EXPIRED)

MIXING into and dabbling with so many malpractice suits, it would be more than strange if I should escape having one of those aggravating experiences myself. Running true to form and, according to the old song, "Everybody got one, and I got mine," I got mine.

While there is nothing of special importance about this suit, I will go considerably into detail so that those who have had no experience in this more or less delightful (?) diversion may know something of how a matter of this kind should be and usually is handled.

I treated a rather stout German woman, 41 years of age, for a simple hypertrophic goiter, which, because it almost completely surrounded her trachea—and she did not want it to be operated on—needed reduction in size. This occurred in 1918. Desiring to secure the promptest result in the shortest possible time, I gave the treatments with a short anode skin distance, as we were in the habit of doing in those days. In addition to the usual steadying and restraint by sand-bags, the patient was cautioned each time that she must not raise her head during the treatments. She had some difficulty in breathing unless her head was tilted slightly forward.

During the application of one of the treatments, I saw her raise her head several times, and at one time I shut off the current to caution her about this. About ten days later she developed a mild second degree dermatitis (only a few small blisters forming), which healed completely with-

out scarring, and did not interfere with the progress of her cure.

At the time that I discharged her, the thyroid had receded markedly in size, and she had no difficulty in breathing. We were on the best of terms, and she promised to pay me the balance of my fee which was still due. After waiting something over two years—for the statutory limitation to expire—for this balance, I demanded payment, and, failing to receive it after repeated duns, I placed the account with a collection agency which gets rough with recalcitrant debtors. Not receiving a reply to their invitation to pay, this agency threatened to sue for my fee, and within a few days I received a letter from an attorney, reading as follows:

"I have been retained by Mrs. N—
H— for the purpose of instituting suit against you by reason of malpractice on your part, whereby Mrs. H— suffered not only severe but almost fatal x-ray burns at your hands.

"I believe that this matter can be compromised if you see fit. Should I fail to hear from you promptly in reference to this matter, I will immediately institute legal proceedings against you to recover the damages she has sustained; so kindly govern yourself accordingly.

H— G. I—."

I immediately notified my insurance carrier as follows: "Yesterday afternoon I received the following letter [quoting the foregoing letter *verbatim*].

"Let me know what, if any, reply I should make.

"As regards the status of this case. In the first place, I have had no dealings of any kind with this patient since May 22, 1919, at which time she received the last treatment from me and paid me \$20 on account. She did receive a very mild

¹ The Editor desires to state that much of the matter herein, because quotations of court proceedings, has to be printed in form as received, without normal punctuation or phrasing.

second degree roentgen dermatitis, as the result of a treatment administered by me on Nov. 11, 1918. She owes me a balance of \$20 (her total fee was \$200), and a short time ago I placed the account with a collector. This firm threatened suit, and this threat of suit against me is the result of my trying to collect the balance.

"If I understand things correctly, the limitation has expired as far as a suit in tort is concerned, it being more than three years since the acts on my part which caused the alleged injury and over two years and nine months since I have seen her or administered any treatment of any kind."

In a very few days, I had the following letter from the law department of my insurance carrier:

"Your communication of the 11th instant with copy of letter addressed to you from H— G. I—, lawyer, of Chicago, is acknowledged, and we would suggest the following reply:

"H— G. I—, etc., I beg to acknowledge receipt of your communication of the 8th instant presenting an alleged claim of Mrs. N— H—.

"In order that I might locate my records of the treatment rendered this patient I would be pleased to have you advise me when Mrs. H— consulted me, and the purpose, and advise me fully as to the number of treatments rendered to this patient.

"I would also be pleased to have your opinion as to my liability and her present condition.

"Thanking you for the courtesy of a reply, I am, etc.

"Respectfully
_____,

"As suggested, write and mail the above letter to the attorney, and in the event of a reply forward same to us, retaining a copy for your records.

"At your convenience, complete the enclosed interrogatories and return.

"You are correct in your understanding that the two years' statute of Illinois applies to action of malpractice.

"Awaiting your advice, we are," etc.

I immediately wrote the above suggested letter to the attorney, and filled out the insurance company's questionnaire as follows:

(Answers only are given, for brevity.)

"1. I. S. Trostler, 25. E. Washington St., Chicago, Ill., College of Medicine, University of Nebraska, 1904. General radiology. Member of Chicago and Illinois State Medical Societies; Fellow A.M.A. and American College of Physicians; member of the Radiological Society of North America, Chicago Roentgen Society, the Roentgen Society, London, Eng., German Medical Society of Chicago, honorary member of several medical societies, etc.

"2. Mrs. N— H—, — M— Ave., Chicago. Housewife, married, age 44 years.

"3. She was treated for retro-laryngeal goiter of simple hypertrophic type, which was causing difficulty in breathing, cough, etc. I first saw her May 18, 1918, and began treatment June 6, 1918.

"When last seen by me, on May 22, 1919, her condition was *very much* improved, so much so that she and I agreed that she would need no more treatment.

"4. June 6, 1918, I gave 6 ma., 12-in. anode skin distance, 7-in. spark gap, through 3 mm. of aluminium and 5 mm. of sole leather filters for 6 minutes; using a broad focus, Universal type Coolidge tube, applied to the anterior surface of the neck; June 22, 1918, I applied the same except that I used 4 mm. of aluminium filter (instead of 3). Ten days later (on July 2, 1918) a dermatitis appeared in the area treated, which developed into a mild second degree roentgen dermatitis, with a few small blisters forming, and which was entirely healed Nov. 11, 1918.

"The urgency of her condition materially subsided, so no x-ray treatment was administered until after healing of the dermatitis. X-ray treatment was resumed Dec. 5, 1918, with 5 mm. aluminium filtration (instead of 3), and three areas were treated, avoiding the area of

the former dermatitis. Procedure on Jan. 2, 1919, same except only two areas treated; Jan. 29, same except 4 mm. aluminium filter used and four areas treated; Feb. 27, 1919, same only three areas; March 27, 1919, same; April 24, 1919, same only 6 mm. aluminium filter and two areas, and May 22, 1919, 5 mm. aluminium filtration to two areas.

"Frequent dressings to the area of dermatitis were applied between July 2, 1918, and Nov. 11, 1918.

"5. Not a fracture case.

"6. X-ray examinations were made by me May 18, 1918. These showed the trachea to be compressed by the thyroid gland.

"7. X-ray dermatitis appeared July 2, 1918, as a typical dermatitis, with redness, itching, stinging, slight swelling, and progression to the formation of several blebs (blisters), and later an ulcer, about two inches by three inches (from above downward) in size, roughly square in form. This healed slowly, under sterile dressings, so that after about four and one-half months there was a clear healed surface with very little scarring, all of which disappeared in four months.

"The apparatus used was a Victor Peerless transformer outfit, with auto-transformer and rheostat controls of the most approved type, with Coolidge tube, transformer and control. Other particulars are given in reply to Question Number 4.

"Rontgen dermatitis was due entirely to patient having raised her head and consequently shortened (or reduced) the target (anode) skin distance from 12 inches to somewhat less than 10 inches, for a considerable part of the time during the second (June 22, 1918) treatment. She was receiving as much as her skin would tolerate with safety, so as to secure the utmost benefit from the treatment in the least possible time, and this apparently slight derangement or disarrangement of conditions caused her to receive an excessive amount of x-rays, the dermatitis resulting therefrom. Her skin is very susceptible to x-rays, and the difference between the

twelve-inch anode skin distance and the less than ten-inch anode skin distance was sufficient to produce the skin injury. The dosage delivered at ten inches from the target of the tube is something like one and one-third times that delivered at twelve-inch target skin distance, and when, as in this instance, the distance was less than ten inches some of the time, and the margin of safety was so small, because of the urgency of the case, the difference in the dosage delivered was more than the skin could tolerate.

"Understand me, I am not trying to give an excuse, but merely stating facts, provable by expert witnesses.

"8. Not treated before for the goiter; but had had treatment for bronchitis, etc., which was apparently caused by the pressure, her excessive weight, etc. I do not know what she received, but she assured me that she was not benefited by the previous treatment. She was referred to me for x-ray examination of her thorax and neck by Dr. B. F. M——. I made the examinations and reported the results to him, whereupon he sent her to me for x-ray treatment for the enlarged thyroid. This physician and I are very friendly.

"9. On March 9, 1922, I received a letter from H. G. I——, dated March 8, 1922, which I copied and sent to you and which contains all that I know of her claims."

(Questions and answers Numbers 10 and 11 are omitted, as unimportant.)

"12. Services were administered while patient was in hospital, she coming there each time for treatment, except for dressings, during the period of the dermatitis, when they were applied at my office at 615 Garfield Avenue. I owned the x-ray plant, the same not being the property of the hospital, operated it as the x-ray department of the hospital, collected all the fees, and the conduct and management of that department was in no way connected with the hospital or its management, nor was the patient in any way a hospital patient.

"13. Patient (or her husband) owes me a

balance of \$20. Knowing the possibility of their making claim of malpractice I did not push this claim very hard until limitation for tort had expired. After the expiration of two and one-half years, debtor not responding to duns, I placed the bill in hands of a collection agency which notified the patient that unless the claim was settled they would bring suit. I have directed this agency to hold off any further action."

In due time I received acknowledgment of the foregoing statement, with assurance that, "There is nothing for you to do except to await developments or the initial move on the part of the claimant, or her attorney. We want to assure you that the matter will be kept well in hand by us and that we will do everything within our power to prevent suit, but if our efforts are unavailing, and suit is filed, notify us immediately and forward all papers served on you."

About one month later I had occasion to write the following to the insurance company: "I wrote to Mr. H. G. I.—as per the copy you sent me. To-day (after one month and two days) he called me over the telephone and asked me to make an appointment, either at his office or mine, so that we could talk the matter over.

"I asked him to allow me one week's time as I was very busy and wanted to consult my attorneys. He agreed to this, saying that he intended to bring action if I did not arrange a satisfactory settlement. He also mentioned that the limitation, which I seemed to think had expired, had not as far as this case was concerned—that it would not expire until it was known what the outcome of the case would be.

"Please inform me what I should do in the matter."

A few days later, I received the following:

"*In re H— vs. Trostler*, File 11470.

"....., and we note that Mr. I— is awaiting advice from you.

"We suggest that you have Mr. I— come to your office and have him advise

you fully of the claims of Mrs. H— and especially ask him to cite you authority sustaining his position that this suit is not outlawed. You might state to Mr. I— that your treatment at the time was proper and was in accordance with the science of radiology as known in the year of 1918, and that if a burn did follow, it was not due to negligence or lack of skill on your part, or to anything omitted to be done by you in the treatment of Mrs. H—. You could further advise Mr. I— that your attorney has advised you that the action is outlawed and that under all circumstances you have no settlement to offer.

"Mr. I— undoubtedly realizes that the action is outlawed and will, of course, make every effort to compromise the case with you.

"We shall await your advice in the premises."

After receipt of the foregoing, I tried to get in telephonic communication with the lawyer, but failing to do so, I wrote: "As *per* agreement, I called you up to-day (after conferring with my attorney), but you were out. I left my telephone number for you to call me, but have failed to hear from you.

"If you care to have a conference with me, and will call me by telephone, I will be glad to arrange for some satisfactory time that you can meet me in my office."

We arranged for a conference in my office, which occurred without any fruitful or definite conclusions. I concluded that he was bluffing.

Several months passed without any further developments. At that time the insurance company wrote me:

"*Re H— vs. Trostler*, File 11470.

"Relative to the above entitled matter, we would be pleased to know whether or not you have heard anything further from Mrs. H— or anyone in her behalf concerning suit.

"If no developments have occurred herein, we do not believe that action will be taken by Mrs. H—. At all events, any action at this time would be outlawed.

"We are of the opinion that we can dispose of this matter in our records, but before taking this step we would appreciate your report together with your advice as to whether or not the matter was handled by us in a manner that would merit your approval. Such was our endeavor and we are only hopeful that we have succeeded in that behalf, but upon this point we shall await your advice.

"It is understood, of course, that in the event we do dispose of the file at this time, the same will be reopened in the event any action is taken by Mrs. H—.

"Awaiting your reply," etc.

After the lapse of about ten months following the conference between Mr. I—, attorney for Mrs. H—, I was called over the telephone by the attorney, and I at that time informed him that I knew that he was aware that he had no case, that the cause, if any had ever existed, was outlawed by the statute of limitations, and that I did not care to waste any more time on the matter. He said that he would submit a proposition to me, and I agreed to consider it. In a few days I received the following communication, dated Feb. 23, 1923:

"In accordance with conversations of recent date, I am submitting for final and immediate consideration by you, the proposition that the claim of Mrs. N— H— of this city against yourself, be put to a board of arbitrators, as previously outlined, namely: One doctor to be chosen by you, one doctor to be chosen by Mrs. H—, and the two arbitrators thus appointed to select a third, a licensed, practising attorney-at-law and admitted to the Supreme Court of the State of Illinois, to hear and determine the amount of damages Mrs. H— is entitled to by reason of the x-ray burns inflicted upon her at some date last past; the reasonable costs of the proceedings to be borne as follows: You to bear the expense of your arbitrator, Mrs. H— to bear the expense of her arbitrator, and the expense of the third arbitrator to be prorated between yourself and Mrs. H—, the arbitrators to return a finding or award

upon the hearing of all the evidence, according to the law, both statutory and common, in reference to arbitration and award, in the State of Illinois. I shall require a definite answer on this by Monday, Feb. 26, 1923, and upon your failure to acquiesce therein, I propose without delay to take such steps in the premises as I may deem expedient and advisable, of which you are undoubtedly informed at this time. This matter has dragged entirely too long and the censure which I have received at the hands of my client for the delay is well merited.

"Very truly yours,

"H— G. I—."

I immediately wrote the insurance company as follows: "On February 1st, pursuant to a telephone appointment, Mr. I—, attorney for Mrs. H—, called upon me and informed me that Mrs. N— H— claimed that I had damaged her, etc. He further said that he and his client were willing to submit to arbitration in the matter and agreed to send me a letter outlining the details of such arbitration, within a few days.

"I informed him—as directed in your letter of April 18, 1922—that my 'treatment at the time was proper and in accord with the science of radiology, as known in the year 1918, and if any injury resulted, it was not due to negligence or lack of skill on my part or to anything omitted to be done in the treatment of Mrs. H—.' I also told Mr. I— that my attorneys inform me that the action is outlawed.

"His reply to the above was that he was connected with two other cases, which, if this case was not settled, would bring joint action against me. This latter was said in the tone of voice that he is in the habit of using—that of a big, blustering, and bombastic bluffer. I have not the least idea what or whom he refers to and am not worrying at all about his remark; but I mention it so that you may know about it.

"I heard nothing further from this attorney until to-day, when I received in the mail, the letter of which the attached is an exact copy. I have not made reply to

this, even though he insists upon my answer by Feb. 26, 1923. Let me know what, if any, reply I should make, or take up the matter with him direct if you deem it best." I sent a *verbatim* copy of the letter from Mr. I— relative to arbitration, along with foregoing.

By return mail, came the following from the insurance company:

"*In re H— vs. Trostler*, File 11470.

"Your communication of the 24th instant together with letter dated February 23rd, addressed to yourself from Mr. I— is acknowledged. We suggest the following reply to Mr. I—:

"I have your letter of the 23rd with reference to alleged claim of your client Mrs. N— H—. I note your proposal that this matter be submitted to a Board of Arbitrators. After carefully reviewing my treatment, I am confident that what I did was proper under the circumstances and is exactly the treatment that should have been rendered at the time. I am in a position to vindicate this treatment if necessary, and for that reason I am of the opinion that there is nothing to arbitrate so far as I am concerned.

"For your information, you are advised that services were rendered to Mrs. H— from June, 1918, to and including May, 1919. Mrs. H— has allowed practically four years to lapse before coming to realize that she had been previously injured. It is a matter of common knowledge that if any injury was occasioned by the x-ray, it would not have taken four years for that condition to manifest itself. The claims of your client, therefore, are absurd in the light of scientific knowledge.

"While I would dislike very much to be subjected to a malpractice suit, I nevertheless will not enter into any compromise or agreement to arbitrate a matter where no merit exists, nor shall I enter into any settlement, thus confessing a liability that does not exist. If your client feels that she has any meritorious claim against me, she may proceed as she deems expedient.

"I am confident that if you will investigate the matter, you will take no action.

"Assuring you of my appreciation of your courtesies, I am," etc.

According to instructions, I wrote to attorney I— as above and in three months received a summons and notice of suit for \$15,000 damages. The charge was trespass. This I immediately transmitted to the insurance company, at the same time notifying the Chairman of the Medico-legal Committee of the Illinois State Medical Society (from which I received a voluminous information blank to fill out). The attorney for the insurance company who had been handling this affair, immediately wrote me: "We have your letter of the 9th instant together with the summons in the above action for acknowledgment. The summons has been forwarded to Mr. E— W. R—, 105 S. LaSalle St., your city, who will enter his appearance for you and will proceed to the defense of the case for you on our behalf.

"We suggest that you arrange with Mr. R— for a conference, advising us that you have done this.

"It occurs to us that this action is outlawed although this question can be determined after we review the declaration filed against you."

Accompanying the information blank from the attorney of the Illinois State Medical Society I received the following:

"*Re: Malpractice Suit.*—I am advised by Dr. C. B. K— that a suit has been begun against you for alleged burns, and that you have sent the summons to the insurance company. I have talked to their attorney regarding it, and judge from what he says that this lawsuit should not give you much concern.

"I enclose one of our usual information blanks and ask that you kindly fill in the information requested at your early convenience and return to me. I shall then be glad to co-operate with the insurance company in the active defense of the suit.

R— J. F—."

Under date of June 19, 1923, Mr. F—, the attorney for the Illinois State Medical Society, wrote me:

"*Re: H— vs. Trostler.*—The complaint or

declaration in this case has now been filed, and I judge that they have the year in-correctly stated.

"Will you please check your records again to be certain about them as this will be quite important. They allege that you were employed about June 6, 1922, and treated the woman after that time."

At the time the foregoing letter was sent to my office, I was with the Radiological Society party, en route to the Mid-annual meeting at San Francisco, and received it there. I immediately telegraphed: "Dates given in my report of H— case are correct. I was no longer at St. Joseph's Hospital, where all treatments were administered to Mrs. H—, in 1922. I left that hospital Aug. 1, 1920, moving to my private offices at 25 East Washington Street. Date in plaintiff's declaration is wrong."

Mr. F— immediately replied: "I thank you for your wire advising that the dates in your report of the H— case are correct. Having that in mind, you will not need to worry about this lawsuit."

I heard nothing further from this affair until Nov. 30, 1924, when after another lapse of over seventeen months, I received the following from R— J. F—, attorney for the Illinois State Medical Society:

"*Re: H— vs. Trostler.*—Mr. R— and I were in court on this case to-day and succeeded in getting judgment on the pleadings in your favor. The plaintiff prayed an appeal, but I am certain it will never be perfected, so to-day ends the celebrated case of N— H—.

"With congratulations on your being through with this, without the necessity of a trial, I remain, . . ."

Two days later I had the following from the insurance company: "We are advised by our Mr. R— that he has finally disposed of the case against you on the pleadings.

"It is the disposition of this company to meet the full expectations of our contract holders in every instance in which we have the opportunity to serve them. It is our hope that we have met your expectation.

We would be pleased to hear from you in this connection and to know whether or not the service which we endeavored to render in this case has met with your approval."

(The phrase "the pleading," in the two foregoing letters, refers to the defense pleaded that the statute of limitations had lapsed and expired. This was deemed to be the shortest, easiest, and most direct way out, and was stressed by both attorneys in my behalf.

Thus ended the only case in malpractice that has ever been filed against me; but I have my fingers crossed, my tongue in my left cheek, and I am knocking wood, as I write this. While the recitation of this suit may seem to be prolix and unnecessarily detailed, it is my desire to indicate the extreme importance of detailed reports to the insurance carrier and the State society's attorneys or committees, in the first place; and how very important are the records in every case, and of nature must be, so that these reports may be correct and detailed. It is important that he who is threatened with suit immediately notify his insurance carrier; but in my opinion, it is not so immediately necessary to inform the State society when suit is *only threatened*. In fact, I do not believe that they ask for such information. It is the business and duty of the insurance carriers, if, as, or when suit is threatened, to direct you so that the threat does not materialize into the filing of a suit, and, as a matter of fact, that is more a part of their service than many of us realize. I have said many times that the best way to defeat a malpractice suit is not to be sued. This is much more a truism than it is an aphorism.

Another of the lessons it is desired to drive home is that *not one word of admission of liability must be made*, and it is far better—under any circumstances—not to assume even the responsibility of answering the simplest questions, if we are not absolutely certain what the legal construction of the matter is or might be. In this case, the lawyer for the plaintiff tried to trap me into agreeing to arbitrate, thus admitting that

there might be some liability. That is only one of the scheming traps that shrewd lawyers use or try to use. There are many of these, some of which are applicable at one time, while others are best used "elsewhere and to-morrow." It has always been my dictum, and I have repeatedly advised men who have insurance, to secure the advice of the insurance carrier, advancing such of their own observations as in their opinion might be of aid and assistance, but being guided entirely by what the more experienced, trained defense attorneys suggest or advise. I did this because I had reason to believe that the company in which I carried my protection knew best how to handle the situation. If I had not had that confidence I would not have been paying the premium for their contract. I bought what I thought was the best, just as I buy a certain kind of x-ray film or fountain pen. Having used or known something about malpractice insurance, x-ray films, and fountain pens, because of quite a few years in the practice of medicine, I selected the kind I wanted, and used it according to directions with satisfactory results.

RÉSUMÉ

After presenting the final paper of this series I feel that a brief summary will explain why it seemed suitable to add "Some of the Lessons to be Learned" to the title of this series. It is, of course, understood that I have been trying to teach something of legal medicine to my readers.

It has been said that "proof of the pudding is the eating thereof"; but in my opinion, this saying or maxim is only half true if applied to this series of papers. Though my readers have read what I presented—eaten the pudding—unless they profit by what they have read—digested and assimilated the pudding—they will not be benefited as I had hoped they would be.

It has been my purpose to purvey mental food to the readers, and if they have read, thought about, and *made theirs* whatever they deemed to be of sufficient value or use, from what has been presented, it is my sincere hope that they have received and acquired the mental nourishment that has been the purpose and aim of the purveyor. If I have been able to present a single thought that helped prevent or forestall one malpractice suit or save one moment of embarrassment upon the witness stand I will feel amply repaid for the time and effort expended.

Having opened this series with a quotation from the Gospel of St. Luke, I trust that I may be pardoned when, in closing, I quote from "The Great Emancipator" and say, in all sincerity, "I do the very best I know how; the very best I can; and I mean to keep doing so until the end. If the end brings me out all right, what is said against me won't amount to anything. If the end brings me out wrong, ten angels swearing I was right would make no difference." *What a splendid addition that would make to our Oath of Hippocrates.*

RADIOLOGICAL SOCIETIES IN THE UNITED STATES

CALENDAR

Meetings Falling Between the Dates of November 15 and December 31.

November 20. Texas Radiological Society annual meeting at the Adolphus Hotel, Dallas, Texas.

Editor's Note.—Will secretaries of societies please co-operate with the Editor by supplying him with information for this page.

CALIFORNIA

California Medical Association, Section on Radiology.—Chairman, John D. Lawson, M.D., 1306 California State Bldg., Sacramento; Secretary, Karl M. Bonoff, M.D., 1930 Wilshire Blvd., Los Angeles. Meets annually with California Medical Association.

Los Angeles County Medical Association, Radiological Section.—President, D. R. McColl, M.D.; Vice-president, John F. Chapman, M.D.; Secretary, E. N. Liljedahl, M.D.; Treasurer, Henry Snure, M.D. Meets every second Wednesday of month at County Society Building.

Pacific Roentgen Club.—Chairman, Raymond G. Taylor, M.D., 1212 Shatto St., Los Angeles; Secretary, L. Henry Garland, M.D., 450 Sutter St., San Francisco.

COLORADO

Denver Radiological Club.—President, W. Walter Wasson, M.D., 246 Metropolitan Bldg.; Vice-president, Ernst A. Schmidt, M.D., Colorado General Hospital; Secretary, Nathan B. Newcomer, M.D., 306 Republic Bldg.; Treasurer, Leonard G. Crosby, M.D., 366 Metropolitan Bldg. Meets third Tuesday of each month at homes of members.

CONNECTICUT

Connecticut State Medical Society, Section on Radiology.—Chairman, Kenneth K. Kinney, M.D., 29 North Street, Willimantic; Vice-chairman, Francis M. Dunn, M.D., 100 State Street, New London; Secretary-Treasurer, Max Climann, M.D., 242 Trumbull St., Hartford. Meetings twice annually in May and September.

DELAWARE

Affiliated with Philadelphia Roentgen Ray Society.

FLORIDA

Florida State Radiological Society.—President, Gerald Raap, M.D., 168 S. E. First St., Miami; Vice-president, H. O. Brown, M.D., 404 First Nat'l Bank Bldg., Tampa; Secretary-Treasurer, H. B. McEuen, M.D., 126 W. Adams St., Jacksonville.

ILLINOIS

Chicago Roentgen Society.—President, David S. Beilin, M.D., 411 Garfield Ave.; Vice-president, Chester J.

Challenger, M.D., 3117 Logan Blvd.; Secretary-Treasurer, Roe J. Maier, M.D., 7752 Halsted St. Meets second Thursday of each month, September to May, except December.

Illinois Radiological Society.—President, Ivan Brouse, M.D., 316 W. State, Jacksonville; Vice-president, Cesar Gianturco, M.D., Carle Hospital Clinic, Urbana; Secretary-Treasurer, Edmund P. Halley, M.D., 968 Citizens Bldg., Decatur. Meetings quarterly by announcement.

Illinois State Medical Society, Section of Radiology.—President, Roswell T. Pettit, M.D., 728 Columbus St., Ottawa; Secretary, Ralph G. Willy, M.D., 1138 N. Leavitt St., Chicago.

INDIANA

Indiana Roentgen Society.—President, J. N. Collins, M.D., 23 E. Ohio St., Indianapolis; President-elect, Stanley Clark, M.D., 108 N. Main St., South Bend; Vice-president, Juan Rodriguez, M.D., 2903 Fairfield Ave. Fort Wayne; Secretary-Treasurer, Clifford C. Taylor, M.D., 23 E. Ohio St., Indianapolis. Annual meeting in May.

IOWA

The Iowa X-ray Club.—Holds luncheon and business meeting during annual session of Iowa State Medical Society.

MAINE

See New England Roentgen Ray Society.

MARYLAND

Baltimore City Medical Society, Radiological Section.—Secretary, H. E. Wright, M.D., 101 W. Read St., Baltimore. Meetings each Monday night.

MASSACHUSETTS

See New England Roentgen Ray Society.

MICHIGAN

Detroit X-ray and Radium Society.—President, C. C. Birkelo, M.D., Herman Keifer Hospital; Vice-president, E. W. Hall, M.D., 10 Peterboro St.; Secretary-Treasurer, E. R. Witwer, M.D., Harper Hospital. Meetings first Thursday of each month from October to May, inclusive, at Wayne County Medical Society Bldg.

Michigan Association of Roentgenologists.—President, J. C. Kenning, M.D., 1536 David Whitney Bldg., Detroit; Vice-president, A. W. Chase, M.D., 133 Toledo St., Adrain; Secretary-Treasurer, C. S. Davenport, M.D., 609 Carey St., Lansing.

MINNESOTA

Minnesota Radiological Society.—President, Walter H. Ude, M.D., 78 S. 9th St., Minneapolis; Vice-president, Leo G. Rigler, M.D., University Hospitals, Min-

neapolis; *Secretary-Treasurer*, Harry Weber, M.D., 102 Second Ave., S. W., Rochester. Meetings quarterly.

MISSOURI

The Kansas City Radiological Society.—*President*, L. G. Allen, M.D., 907 N. 7th St., Kansas City, Mo.; *Secretary*, Ira H. Lockwood, M.D., 306 E. 12th St., Kansas City, Mo. Meetings last Thursday of each month.

The St. Louis Society of Radiologists.—*President*, Joseph C. Peden, M.D., 634 N. Grand Blvd.; *Secretary*, W. K. Mueller, M.D., 607 N. Grand Blvd. Meetings fourth Wednesday of each month.

NEBRASKA

Nebraska Radiological Society.—*President*, E. W. Rowe, M.D., 128 N. 13th St., Lincoln; *Secretary*, D. Arnold Dowell, M.D., 117 S. 17th St., Omaha. Meetings first Wednesday of each month at 6 P.M. in Omaha or Lincoln.

NEW ENGLAND ROENTGEN RAY SOCIETY

(Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island.) *President*, Frank E. Wheatley, M.D., 520 Beacon St., Boston; *Secretary*, E. C. Vogt, M.D., 300 Longwood Ave., Boston. Meetings third Friday of each month from October to May, inclusive, usually at Boston Medical Library.

NEW HAMPSHIRE

See New England Roentgen Ray Society.

NEW JERSEY

Radiological Society of New Jersey.—*President*, J. D. Tidaback, M.D., 382 Springfield, Summit; *Vice-president*, Milton Friedman, M.D., Newark Beth Israel Hospital, Newark; *Secretary*, P. S. Avery, M.D., 546 Central Ave., Bound Brook. Meetings at Atlantic City at time of State Medical Society, and Midwinter in Newark as called by president.

NEW YORK

Brooklyn Roentgen Society.—*President*, Albert Voltz, M.D., 115-120 Myrtle Avenue, Richmond Hill; *Vice-president*, A. L. L. Bell, M.D., Long Island College Hospital, Henry, Pacific, and Amity Sts., Brooklyn; *Secretary-Treasurer*, E. Mendelson, M.D., 132 Parkside Ave., Brooklyn. Meetings first Tuesday in each month at place designated by president.

Buffalo Radiological Society.—*President*, John Barnes, M.D., 875 Lafayette Ave.; *Vice-president*, W. L. Mattick, M.D., 290 Highland Drive; *Secretary-Treasurer*, J. S. Gian-Franceschi, M.D., 610 Niagara Street. Meetings second Monday evening each month.

Central New York Roentgen-ray Society.—*President*, W. E. Achilles, M.D., 60 Seneca St., Geneva; *Vice-president*, M. T. Powers, M.D., 250 Genesee St., Utica; *Secretary-Treasurer*, Carlton F. Potter, M.D., 425 Waverly Ave., Syracuse. Meetings held in

January, May, and October as called by Executive Committee.

Long Island Radiological Society.—*President*, David E. Ehrlich, M.D., 27 W. 86th St., New York City; *Vice-president*, H. Koiransky, M.D., 43-37 47th St., Long Island City; *Secretary*, S. Schenck, M.D., 115 Eastern Parkway, Brooklyn; *Treasurer*, Moses Goodman, M.D., 45-01 Skillman Ave., Long Island City. Meetings third Thursday evening each month at Kings County Medical Bldg.

New York Roentgen Society.—*President*, E. F. Merrill, M.D., 30 W. 59th St., New York City; *Vice-president*, I. W. Lewis, M.D.; *Secretary*, H. K. Taylor, M.D., 667 Madison Ave., New York City; *Treasurer*, R. D. Duckworth, M.D., 170 Maple Ave., White Plains. Meetings third Monday evening each month at Academy of Medicine.

Rochester Roentgen-ray Society.—*Chairman*, Joseph H. Green, M.D., 277 Alexander St.; *Secretary*, S. C. Davidson, M.D., 277 Alexander St. Meetings at convenience of committee.

Society of Radiological Economics of New York.—*President*, Albert L. Voltz, M.D., 115-120 Myrtle Ave., Richmond Hill; *Vice-president*, M. M. Pomeranz, M.D., 911 Park Ave., New York City; *Secretary*, W. F. Francis, M.D.; *Treasurer*, Theodore West, M.D., United Hospital, Port Chester. Meetings first Monday evening each month at McAlpin Hotel.

NORTH CAROLINA

Radiological Society of North Carolina.—*President*, Robert P. Noble, M.D., 127 W. Hargett St., Raleigh; *Vice-president*, A. L. Daughtridge, M.D., 144 Coast Line St., Rocky Mount; *Secretary-Treasurer*, Major I. Fleming, M.D., 404 Falls Road, Rocky Mount. Meetings with State meeting in May, and meeting in October.

OHIO

Cleveland Radiological Society.—*President*, North W. Shetter, M.D., Lakewood City Hospital, Lakewood; *Vice-president*, John Heberding, M.D., St. Elizabeth's Hospital, Youngstown; *Secretary-Treasurer*, Harry Hauser, M.D., Cleveland City Hospital, Cleveland. Meetings at 6:30 P.M. at Cleveland Chamber of Commerce Club on fourth Monday of each month from October to April, inclusive.

Radiological Society of the Academy of Medicine (Cincinnati Roentgenologists).—*President*, George Benzing, M.D., St. Elizabeth Hospital, Covington, Ky.; *Secretary-Treasurer*, Justin E. McCarthy, M.D., 707 Race St., Cincinnati, Ohio. Meetings held third Tuesday of each month.

PENNSYLVANIA

Pennsylvania Radiological Society.—*President*, Sydney J. Hawley, M.D., Geisinger Memorial Hospital

Danville; *First Vice-president*, William J. McGregor, M.D., 744 Franklin Ave., Wilkinsburg; *Second Vice-president*, Oscar M. Weaver, M.D., 12 S. Main St., Lewistown; *Secretary-Treasurer*, Lloyd E. Wurster, M.D., 416 Pine St., Williamsport; *President-elect*, Charles S. Caldwell, M.D., 520 S. Aiken Ave., Pittsburgh. Annual meeting, May, 1938. Exact date and place to be decided.

Philadelphia Roentgen Ray Society.—*President*, Thomas P. Laughery, M.D., Germantown Hospital; *Vice-president*, Elwood E. Downs, M.D., Jeans Hospital, Fox Chase; *Secretary*, Barton H. Young, M.D., Temple University Hospital; *Treasurer*, R. Manges Smith, M.D., Jefferson Hospital. Meetings first Thursday of each month from October to May, Thompson Hall, College of Physicians, 19 S. 22nd St., 8:15 P.M.

The Pittsburgh Roentgen Society.—*President*, F. L. Schumacher, M.D., Jenkins Arcade; *Secretary*, H. N. Mawhinney, M.D., Mercy Hospital. Two Fall and two Spring meetings at time and place designated by president.

RHODE ISLAND

See New England Roentgen Ray Society.

SOUTH CAROLINA

South Carolina X-ray Society.—*President*, Robert B. Taft, M.D., 105 Rutledge Ave., Charleston; *Secretary-Treasurer*, Hillyer Rudisill, M.D., Roper Hospital, Charleston. Meetings in Charleston on first Thursday in November, also at time and place of South Carolina State Medical Association.

SOUTH DAKOTA

Meets with Minnesota Radiological Society.

TENNESSEE

Memphis Roentgen Club.—Chairmanship rotates monthly in alphabetical order. Meetings second Tuesday of each month at University Center.

Tennessee State Radiological Society.—*President*, H. S. Shoulders, M.D., 246 Doctors Bldg., Nashville; *Vice-president*, S. S. Marchbanks, M.D., 508 Medical Arts Bldg., Chattanooga; *Secretary-Treasurer*, Franklin B. Bogart, M.D., 311 Medical Arts Bldg., Chattanooga. Meeting annually with State Medical Society in April.

VERMONT

See New England Roentgen Ray Society.

VIRGINIA

Radiological Society of Virginia.—*President*, Fred M. Hodges, M.D., 100 W. Franklin St., Richmond; *Vice-president*, L. F. Magruder, M.D., Raleigh and College Aves., Norfolk; *Secretary*, V. W. Archer, M.D., University of Virginia Hospital, Charlottesville.

WASHINGTON

Washington State Radiological Society.—*President*, H. E. Nichols, M.D., Stimson Bldg., Seattle; *Secretary*, T. T. Dawson, M.D., Fourth and Pike Bldg., Seattle. Meetings fourth Monday of each month at College Club.

NEWS ITEM

Section on Radiology of Connecticut State Medical Society met Sept. 22, 1937, at the New Haven Hospital. Dr. Bradley L. Coley, of the Memorial Hospital, New York City, spoke on "Diagnosis and Treatment of Bone Tumors in Children."

EDITORIAL

LEON J. MENVILLE, M.D., *Editor*

HOWARD P. DOUB, M.D., *Associate Editor*

EXCRETORY UROGRAPHY

Excretory urography has become one of the important methods of examination of the urinary tract; for this reason, it seems pertinent to evaluate its field of applicability and its limitations as a diagnostic procedure. It is simple to carry out and, wherever a roentgenologist has adequate facilities, is being used more and more frequently. At the same time, greater responsibility is placed on the radiologist for interpretation of a urogram with its diagnostic possibilities.

We should never forget the contribution of Rowntree who, in 1929, conceived the possibility of such a method of examination, making it pass from a dream to a reality, and of Binz, von Lichtenberg, and Swick who perfected the method. Previous to the publication of the work of these men, the practice of pyelography required the art of a urologist in all cases and most radiologists were quite dependent upon the urologists for interpretation. Now that excretory urography is widely practised in small hospitals and in many places where a urologist is not available, grave responsibility is placed upon the radiologist, for which he should prepare himself by a careful analysis of all publications on this subject.

At the present time it would seem that perhaps the greatest value of excretory urography lies in determining the absence of pathological changes, thereby eliminating the urinary tract as the cause of symptoms. Perhaps next in importance is something which everyone doing this work has questioned—what is its value as a test of kidney function? This question has been studied by Braasch, who made a careful analysis of a series of 60 cases of various lesions of the urinary tract. By comparing the results secured by excretory urography with those secured by indigo carmine tests, he found that the two methods were of about equal value in 78 per cent of the cases, while in 22 per cent they were not in agreement. From a comparative check with other methods of testing the function and from autopsy findings, he concluded

that excretory urography gave a quite accurate test in the presence of hydronephrosis, pyelonephritis, polycystic kidney, and solitary cyst of the kidney. While it may often give inaccurate results in the presence of renal tuberculosis and calculous disease, Braasch adds that indigo carmine tests are also often inaccurate when these conditions are present, but the additional information gained by knowledge of an anatomical deformity may make up for the discrepancy.

We have found that it is most valuable to follow a routine method of examination in all cases if our diagnostic acumen and evaluation is to be of high quality.

In our routine the first film is made five minutes after the injection of the dye. At this time the interpretation of the appearance and density of both kidney pelves, ureters, and bladder are of most importance. The next film is made in fifteen minutes and at this time the best filling will usually be obtained. Again the density of the shadow within the kidneys and bladder are observed in order to estimate the function.

It should be possible also at this time to determine hypermotility if present, the kidneys remaining empty. If motility is normal, the kidneys will empty from a filled pelvis. When the emptying occurs rapidly, there may be only a fragmentary visualization of the pelvis and all available films will be necessary to secure a correct outline of the pelves and calices. However, even if the filling is not good, sufficient normal cupping of calices may be seen to rule out pathological change. Observation of the ureters at this time will often determine abnormality in dynamics. Frequently it is necessary to search all films to secure visualization of an entire ureter.

The third examination is made thirty minutes from the time of the introduction of the dye, fifteen minutes after the preceding film. At this time the kidney shadows will be more pale, showing the extent of elimination of the

dye from the blood. Again the density of the bladder shadow is noted and further observation is made of the pelvis and ureters. The fourth film is made at the end of one hour. At this time the urinary tract usually will be practically free from dye and a conclusion of good total function may be made. If the kidneys are still well filled without an obstructive lesion after one hour, a further film may be made which will aid in determining the total renal function.

No compression or other interference with normal activity should be done except possibly a five-minute compression of the ureters before the fifteen-minute film is made or directly after this if a repeat film is indicated. To effect compression, two large rolls of bandage may be placed over the ureters at the pelvic brim and a compression band tightly applied.

When there is a question of retention in a ptosed kidney the patient should remain in the upright position and preferably walk about between the examinations. In the advent of a markedly ptosed kidney, either retention may be observed or poor function may indicate disturbance of circulation by rotation of the kidney pedicle, as described by Kimm and Smith.

Tuberculosis of the kidney may produce a very bizarre pattern. By the very nature of the disease, only a localized portion of the kidney may be affected and this may easily be mistaken for a calix that is empty at the time of the examination. The presence of a large or small area of involvement may not be indicated at all by the function; extensive lesions may show fair function while small lesions may show poor function. Pus, blood, and clots may create any kind of visualization. Retrograde pyelography is most essential in the presence of a suspected renal tuberculosis in most cases.

Any type of visualization may also be expected in the presence of a renal tumor, depending on hemorrhage, pressure, renal destruction, and irritability of the kidney, thus making the diagnosis difficult in many cases. Here again retrograde examination will often be found essential.

Excretory urography constitutes an excellent method for the detection of calculous disease. However, there are many times when the findings are very difficult to interpret. Ureteral calculi, if they obstruct the ureter completely, may cause entire cessation of function in the corresponding kidney and no visualization will take place. Likewise, a stone in a calix of the

kidney will obstruct an infundibulum and no visualization will occur. As a whole, however, in unilateral calculi much valuable information may be obtained regarding the sound kidney and a fair estimate of function may be determined in a kidney containing a calculus.

For the detection of anomalies of the kidneys and ureters, this method of examination is usually satisfactory.

When prostatic obstruction prevents the passage of the cystoscope, excretory urography many times is of great value, particularly in determining renal function together with dilatation of the kidneys and ureters. The presence of a high blood urea, however, will preclude the possibility of a satisfactory examination, and drainage, together with a large intake of water to reduce the blood urea, is necessary before a satisfactory examination can be made.

We have found that when a urogram is made following catheterization of the ureters, pseudo-retention will often be seen. Such an examination should not be made soon after catheterization of the ureter. The examination of patients with trauma to the urinary tract may be safely done by excretory urography and a definite diagnosis of a ruptured kidney or bladder may be established by visualization of the opaque medium outside the urinary tract.

The presence of a questionable lesion in a kidney following excretory urography should in most instances be checked by a retrograde pyelogram.

A final diagnosis in pathological lesions should be carefully correlated with kidney symptoms and consultations with an experienced urologist before any radical operative procedure is advised, as many pitfalls will be encountered in this method of examination of the urinary tract and these may only be avoided consistently by the experienced urologist. Only in this manner can the fullest value be obtained by excretory urography.

BERNARD H. NICHOLS, M.D.

COMMUNICATIONS

CANCER AID FOUNDATION

A charter has been issued to the Virginia Cancer Foundation, organized, according to its sponsors, to aid indigent victims of cancer in the State and to carry on cancer research. The Foundation was organized with no capital

stock and on a non-profit basis, "for the purpose of contributing such sums of money as the board of trustees may deem wise, and which the Foundation may possess in excess of its own requirements, to other institutions or individuals in the State of Virginia to be used under proper supervision exclusively for cancer research or for the diagnosis and treatment of indigent cancer patients."

"We hope," said Dr. Wright Clarkson, of Petersburg, Va., director, "to have several million dollars on hand within about ten years. . . . With whatever funds we may accumulate as we go along, we will do what we can for treatment of cancer victims in Virginia who are unable to pay, and we expect to contribute as best we can to organizations engaged in cancer research in the State."

Education of laymen in cancer prevention and early treatment, the Foundation will leave to organizations now engaged in that work.

Men and women prominent throughout the State are officers. Dr. J. Shelton Horsley, Sr., of Richmond, is chairman of the research committee.

RECOMMENDATIONS OF THE INTERNATIONAL COMMITTEE FOR RADIOLOGICAL UNITS (CHICAGO, 1937)

Introduction

Pursuant to the reference to gamma-ray dosage in the recommendations of the International Committee at its 1934 meeting at Zurich, it is now considered that sufficient evidence exists for the provisional adoption of a single unit, the roentgen, as the unit of quantity, not only for x-rays but also for gamma rays. To do this it is necessary to adopt a somewhat more generalized definition of the roentgen and this is given below. It is proposed that this definition be regarded as provisional and that a more exact definition to include all classes of radiation be prepared for the next Congress.

Section A: Units

1. The International Unit of *quantity* or *dose* of x-rays or gamma rays shall be called the "roentgen" and shall be designated by the symbol "r".

2. The roentgen shall be the quantity of x- or gamma-radiation such that the associated corpuscular emission per 0.001293 gram of air produces, in air, ions carrying 1 e.s.u. of quan-

tity of electricity of either sign. (See Appendix, Note 1.)

3. Measurements of radiation quantity shall be expressed in roentgens. Measurements of dosage rate shall be expressed in roentgens per minute.

Section B: Dose or the Specification of the Conditions of X-ray Treatment

4. In the description of the conditions of x-ray treatments, distinction shall be made between the quantity of radiation measured in air and the quantity of radiation estimated to have been received by the tissue. Since the symbol, *r*, is reserved for the unit, the amount of the dose may be designated by the letter *D*. The use of subscripts is suggested to distinguish dosage measurement made under different conditions; e.g., in free air—*D*; at the surface of the skin (including back-scatter)—*D₀*, etc. (See Appendix, Note 2.)

5. The specifications of treatment conditions shall include the following:

- I. *Quantity*.—The quantity of radiation (expressed in roentgens) estimated to have been received by the lesion.
- II. *Quality*.—(a) The spectral energy distribution of x-radiation shall be designated by some suitable index, called *quality*. For most medical purposes it is sufficient to express the quality of the x-radiation by the half value layer in a suitable material: Up to 20 kv. (peak) cellophane or cello; 20–120 kv. (peak) aluminum; 120–400 kv. (peak) copper; 400 kv. up (peak) tin. For a more definite specification of the quality of the radiation the complete absorption curve in the same material is preferable. (b) Material and thickness of filter, including tube walls. (c) Target material.
- III. *Technic*.—(a) Total quantity of radiation per field (incident and emergent) received in an entire course of treatment. (b) Quantity of radiation per field measured at the surface (*D₀*) at each individual irradiation. (c) The dosage rate expressed in r/min. during each individual irradiation. (d) The total time over which a course of treatments is spread. (e) The time interval between successive doses. (f) The target-skin distance. (g) The number, dimensions, and location of the ports of entry.

Section C: Dose or the Specification of the Conditions of Gamma-ray Treatments

6. The specification of the conditions of gamma-ray treatments should, where possible, include statements of—

- I. *Quantity*.—The total quantity of radiation (expressed in roentgens) estimated to have been received by the lesion.
- II. *Particulars of Radium Source*.—(a) The total amount and nature of radio-active substance employed (expressed as equivalent mgm. of radium element). (b) Type, number, and distribution of the containers. (c) The material and thickness of filters and the nature of the material externally adjacent to the skin.
- III. *Technic*.—(a) In the case of surface applicators or "large radium units," the quantity of radiation per field at the surface. (b) The dosage rate during each individual irradiation. (c) The total time over which a course of treatments is spread. (d) The time intervals between successive irradiations. (e) In the case of surface applicators or large radium units, the radium-skin distance. (f) The number, dimensions, and situations of the ports of entry.

Section D: Instruments

7. The following types of apparatus are suggested as suitable for the measurement of quantity in roentgens:

(a) *X-ray Primary Standards*.—The free air chamber shall be used for free air measurements for all wave lengths down to the practical limit set by the consideration that the chamber must be of such width and length that the full ionization produced by the corpuscular emission from air is measured in accordance with the definition. An air-wall chamber which meets the requirements of the definition may be used for harder radiations.

(b) *X-ray Practical Instruments*.—The air-wall chamber may be used for clinical measurements of x-ray quantity over the entire voltage range.

(c) *Gamma-ray Standards and Practical Instruments*.—The air-wall chamber may be used for the measurement of primary, scattered, or a combination of both radiations.

8. Instruments used to measure radiation quantity or dosage may conveniently be called dosimeters and dosage-rate (or dose-rate)

meters, respectively, and shall be calibrated in roentgens or roentgens per minute.

9. The calibration readings of dosimeters and dosage-rate meters should be independent of the wave length within the range for which they are designed or used.

10. Dosimeters and dosage-rate meters should be provided with suitable arrangements (e.g., standard radium source, Bronson leak, or capacity sharing device) for checking the reproducibility of their readings.

11. The calibrations of dosimeters or dosage-rate meters should be tested periodically by a recognized testing laboratory over the range of wave lengths for which they are designed or used.

12. The National Standardization Laboratories shall be invited to undertake standard measurement and the calibration of dosimeters relative to all forms of radiation therapy to which these recommendations may apply. They shall also be invited to issue joint reports from time to time thereon.

Section E: Appendix

Note 1.—Note that 0.001293 gram is the mass of 1 c.c. of dry atmospheric air at 0° C. and 760 cm. of mercury pressure.

Note 2.—For example, in an hypothetical case of medium x-rays,

The dose measured in air, D equals 300 r;
The dose measured at the surface, D_0 equals 500 r;

The dose measured at x cm. depth, D_x equals 200 r;

N.B., D is not to be confused with the energy actually absorbed by the tissue.

Section F: Rules Governing the Selection and Work of the International Committee for Radiological Units

13. The International Committee on Radiological Units shall be governed by the following rules:

(a) The International Committee on Radiological Units (I.C.R.U.) shall be composed of two representatives from each country sending delegates to the Congress. These representatives shall be chosen by the National Committee of Delegates for each country. However, any country having a National Standardization Laboratory may have three representatives, one of whom shall be appointed by such laboratory, but the representatives from a single country shall always include one radiologist and one physicist.

(b) The nominations of the above-named representatives of each country shall be communicated through the delegates of that country to the Secretary of the Executive Sub-committee of the International Committee on Radiological Units at least thirty months before the next Congress.

(c) In case new representatives shall not have been appointed or their nominations not have been furnished within the time and in the manner above specified, the former representatives shall be retained and considered to have been re-appointed. In the event of a representative being unable to attend the I.C.R.U. meetings, a substitute may be appointed by the national delegation through its chairman. Similar substitute appointments may be made by the directors of the National Laboratories.

(d) The continuance of the policies and records of the I.C.R.U. shall be in the hands of the standing Executive Sub-committee, consisting of six members elected by the I.C.R.U. from among the members of the whole Committee.

(e) The members of the Executive Sub-committee shall be elected to serve for terms of nine years each. The two senior members shall automatically retire at the end of each Congress but shall be eligible for re-election. A meeting of the I.C.R.U. shall be called on the first day of Congress to fill any vacancies existing in the Executive Sub-committee.

(f) The Executive Sub-committee of the I.C.R.U. shall elect its own Chairman and Secretary from among its members. The Secretary shall be custodian of all records and papers relating to the work of the Committee.

(g) The Executive Sub-committee shall familiarize itself with the progress in the field of dosimetry and prepare the program to be submitted to the main Committee for discussion. A preliminary report thereon shall be published and circularized to all members of the I.C.R.U. at least six months before the meeting of the Congress. The final agenda for the meeting shall be prepared by the Executive Sub-committee on the first day of the Congress. The Executive Sub-committee shall report to the I.C.R.U. on all matters presented to it.

(h) Meetings of the I.C.R.U. shall be presided over by the Chairman, selected from the country in which the Congress is held. He shall be assisted, as may be necessary, by the Executive Sub-committee.

(i) A résumé of any formal discussion pre-

sented at a meeting of the I.C.R.U. by any member must be submitted in writing by such member to the Secretary of the Executive Sub-committee before the same shall be accepted for inclusion in the minutes of the meeting.

Members of the Sub-committee

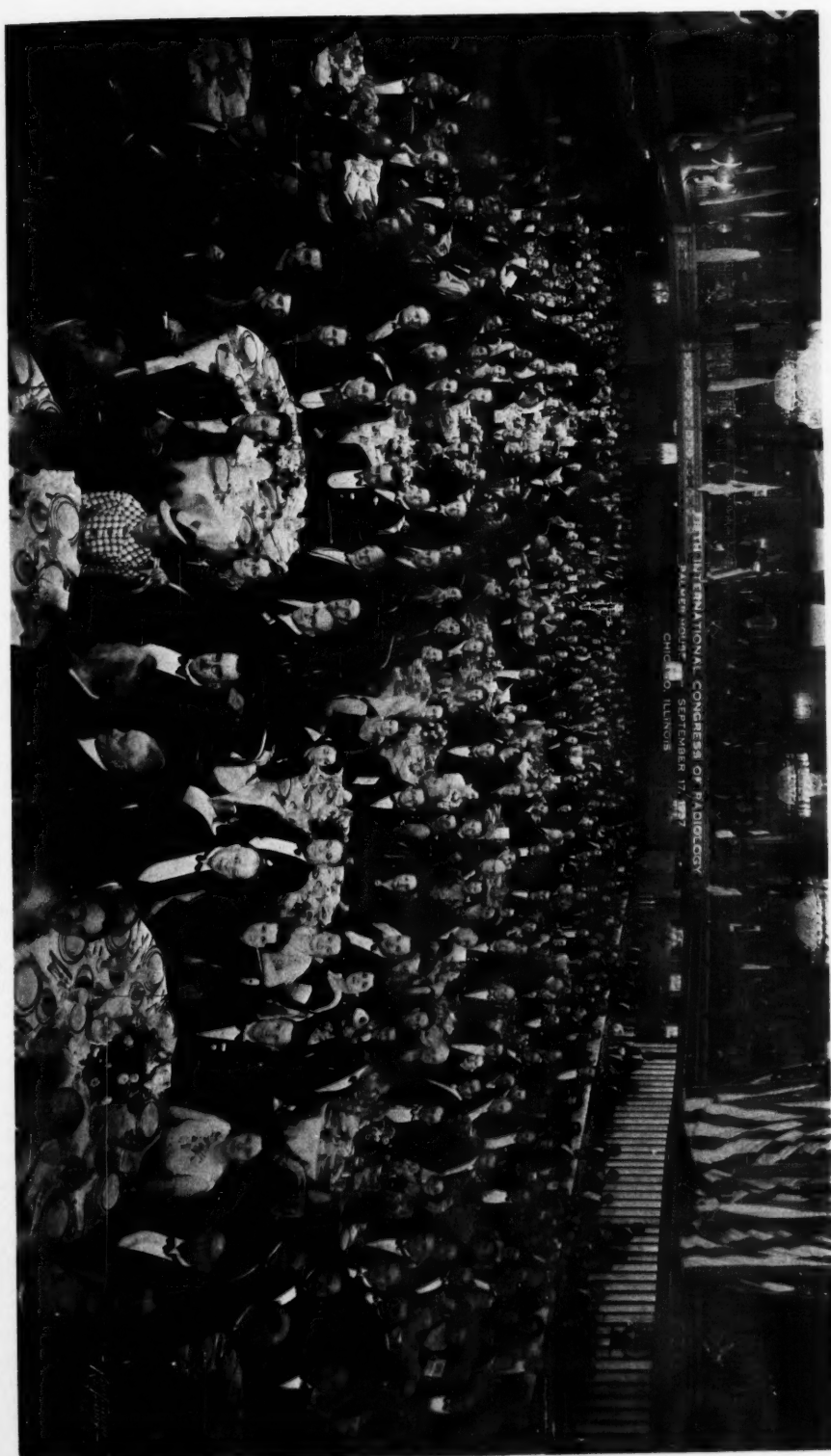
H. Behnken, *Chairman*, term, nine years;
L. S. Taylor, *Secretary*, term, nine years;
E. Pugno-Vanoni, term, six years;
I. Solomon, term, six years;
R. Sievert, term, three years;
F. L. Hopwood, term, three years.

Members of the International Committee for Radiological Units Preparing the Above Report

G. Failla, *Honorary Chairman*, U. S. A.,
I. Solomon, *Chairman*, France,
L. S. Taylor, *Secretary*, U. S. A.,
G. Schwarz, Austria,
J. Juul, Denmark,
H. M. Hansen, Denmark,
H. Holthusen, Germany,
H. Behnken, Germany,
W. Friedrich, Germany,
F. L. Hopwood, Great Britain,
G. W. C. Kaye, Great Britain,
N. S. Finzi, Great Britain,
A. Lambadarides, Greece,
D. den Hoed, Holland,
A. Bouwers, Holland,
M. Ponzio, Italy,
E. Pugno-Vanoni, Italy,
M. Tanaka, Japan,
K. Inouye, Japan,
J. Jovin, Roumania,
E. C. Ernst, U. S. A.,
R. R. Newell, U. S. A.

FIFTH INTERNATIONAL CONGRESS OF RADIOLOGY

The Fifth International Congress of Radiology has passed into history, more fully reported by the lay press of the United States than have been any of its predecessors. For the first time, it would seem, the United States has become aware of what has been going on in this specialty of medicine. The country is becoming radiation-conscious, a condition which is bound to react to the advantage of those who have practised roentgen-ray diagnosis and radiation therapy through the introductory period.



Grand Banquet, Fifth International Congress of Radiology, Chicago

To those who participated in or attended the Congress, no brief résumé of its activities and results is adequate. Figures alone cannot tell the story: in the practices of radiologists will its results be recorded. While the management, under the leadership of President Arthur C. Christie, M.D., and General Secretary B. H. Orndoff, M.D., was masterful and effective, it took more than was possible in these councils to secure the result. The manner in which the presentations of scientific contributions was conducted, the international influence of the projections in several languages, the wide range of the exhibits, the effective publicity, the careful management of the social aspects of the Congress, all resulted from the farseeing plans of the committees. Many small group gatherings made possible a degree of acquaintanceship and an exchange of ideas between radiologists of widely separated countries.

The Sixth International Congress of Radiology is planned to be held in 1940 in Berlin. As each Congress learns from its predecessor, the radiologists of the world will look to that event as a further step in progress.

COLORADO STATE MEDICAL SOCIETY

The Board of Trustees of the Colorado State Medical Society have chosen the dates, Wednesday afternoon to Saturday night, inclusive, September 7, 8, 9, and 10, 1938, as the dates for the sixty-eighth Annual Session of the Colorado State Medical Society, to be held at the Stanley Hotel, Estes Park, Colorado.

These dates were selected following receipt of communications from a large number of medical organizations which indicated these dates would cause the least possible amount of conflict with such other meetings as have been so far definitely scheduled for September, 1938.

A MEMBER HONORED BY STATE SOCIETY

E. M. Van Buskirk, M.D., of Fort Wayne, was made president-elect of the Indiana State Medical Association at the annual meeting of the organization held at French Lick, October 4-6. Dr. Van Buskirk will serve as president in 1939.

BOOK REVIEWS

THE NORMAL ENCEPHALOGRAM. By LEO M. DAVIDOFF, M.D., Assistant Professor of Neurology in the College of Physicians and Surgeons, Columbia University; Attending Neurological Surgeon to the Neurological Institute of New York, and CORNELIUS G. DYKE, M.D., Assistant Professor of Radiology in the College of Physicians and Surgeons, Columbia University; Assistant Director in the Department of Radiology of the Neurological Institute of New York. A volume of 224 pages. Published by Lea & Febiger, Philadelphia, 1937. Price: \$5.50.

Since the use of encephalography was reintroduced in 1921, much has appeared in the literature concerning the use of this procedure in the diagnosis of intracranial disease. Many of the disappointments and much of the criticism that have arisen from the use of this method of examination have been due more to a lack of knowledge concerning the fundamental principles of its use than to any fault of the procedure itself. The interpretation of the resulting films requires not only a familiarity with roentgenography generally, and cranial roentgenography in particular, but a thorough knowledge of the anatomy of the brain and the physiology of the cerebrospinal fluid circulation. Over a number of years the authors have emphasized in their writings the importance of a detailed knowledge of the normal intracranial contents as seen in the encephalogram as a basis for diagnosis of pathological conditions by this method. The object of this book is to present a fundamental thesis on encephalography based not only on the authors' experience with 4,000 cases, but also a review of the literature. The material covered includes a description of the technic, indications, and contra-indications for the performance of the test and the reaction of the patient during and after the procedure. The body of the book is concerned with what might be termed the encephalographic anatomy of the living brain and its coverings viewed by means of the contrasting shadows of tissues and gas in the stereoscopic roentgenogram.

The authors have carried to perfection a radiological monograph that might well be used as an example for consideration of other anatomical structures. Certainly in the past roentgenologic diagnosis has suffered because of an inadequate understanding of the normal on the part of many observers, and it is only

through such fundamental treatises as Davidoff and Dyke have presented that roentgenology can continue to progress in a sane and useful manner.

This concise and timely contribution should have a prominent place on the reading shelf of all who are interested in the diagnosis of intracranial disease. It is hoped that in the near future these same authors will provide an equally informative text on the abnormal encephalogram.

THE DIGESTIVE TRACT: A Radiologic Study of the Anatomy, Physiology, and Pathology. By ALFRED E. BARCLAY, O.B.E., M.A., M.D. (Cantab), D.M.R. and E. (Camb.), M.R.C.D., F.A.C.R., Honorary Radiologist to the Nuffield Institute for Medical Research, Oxford, England. Second Edition. A volume of 427 pages. Published by The Cambridge University Press, London, and the Mac-Millan Company, New York, 1937. Price: \$12.00.

Four years ago the first edition of this text was widely acclaimed by physicians throughout the world. This new edition brings the book abreast of the latest research. It has been entirely reset and many additions and changes have been made. In its present form it constitutes the most comprehensive up-to-date radiologic text concerning the alimentary tract in the English language.

The volume is a summarization of the acquired experience of a quarter of a century in the fluoroscopic and radiographic examination of the alimentary tract. The first part of the book is devoted to technic and a comprehensive consideration of the normal anatomy and physiology of the gastro-intestinal tract. This reflects the author's belief that there is one and only one safe guide to radiologic interpretation and that is a knowledge of the normal.

The author's discussion of the technic of fluoroscopic palpation is the best that has appeared in any text-book and reflects his ability and command of this most valuable procedure. In Barclay's opinion radioscopy palpation is the greatest ally that we have in detecting the finer pathologic changes in the stomach and other organs and is essential for revealing the contour of the folds of the mucous membrane in which small pathologic lesions may be tucked away. He believes that it is doubtful if the

value of this intricate procedure is even fully appreciated by the majority of workers.

The chapter devoted to lesions of the colon is succinct but somewhat brief compared to the importance of the subject. The author apparently is not convinced of the value of the radiologic examination in cases of colitis, for he states that he is very skeptical of the radiological and clinical diagnosis of colitis. American observers will challenge this viewpoint.

In a chapter written in collaboration with Dr. L. A. Rowden, the anatomy, physiology, and pathology of the gall bladder are considered, together with the details of the roentgenologic examination and the interpretation of the roentgenologic findings.

Seven appendices of interest to general radiologists are included in the present volume. The second of these, dealing with the radiation risks of the roentgenologist, should be read by all physicians undertaking x-ray examinations, especially non-radiologists.

This text-book should have a wide appeal to students, physicians, and all radiologists who are interested in an intelligent roentgenologic examination of the alimentary tract.

AMERICAN MEDICINE. Expert Testimony Out of Court. Two volumes, 1,500 pages. Edited and published by The American Foundation, 565 Fifth Avenue, New York City. Price: \$3.50.

The title should be International Medicine, because the problems pertaining to American Medicine are universal in scope and the matter contained in these two volumes can truly be applied to other nations, probably in a varied form, but in spite of modifications the basic principles involved are identical.

The two volumes contain excerpts from approximately five thousand letters, written by some twenty-one hundred physicians, each one of whom received a letter asking him to express an opinion as to the solution of the socioeconomic problems confronting medicine.

The initial letter addressed to these contributors stated that the Foundation had little faith in the effectiveness of questionnaires, therefore, each one was requested to write an extensive treatise according to his own inclinations, without restriction or instruction. Also, the original request had a ring of sincerity and personal appeal which was carried throughout the entire correspondence—there was nothing

stereotyped; one could not help but be favorably impressed. In addition, the membership of the board of trustees of the American Foundation Studies in Government accredits the earnestness and thoroughness of this compilation.

The contributors hail from every State of the Union and represent every phase of medical education and practice, also, various groups as to years of practice.

The following items are some of the pertinent problems:

What is "adequate" medical care?

Is the cost of it the only reason why it is not generally available?

How much modern scientific medical care of high grade exists at all?

If it were "available" now to all, would a large part of the population still choose quacks, cults, and patent medicine?

How far is government responsible for the health of the individual?

What part should government have in promoting public health and providing medical care?

Who should pay for the medical care of the indigent sick?

Is the old line of demarcation between preventive and curative medicine any longer practicable or desirable?

Can an individual doctor really furnish scientific medical care alone, or are organized laboratory and consultative assistance an absolute necessity?

In the medicine of the future will the practitioner function as an individual or as a member of a group?

What is the present status of the family doctor—is he "passing"; or is a new version of him just coming into being?

Is the "doctor-patient-relationship" an absolute sentimentality or has it a practical value in modern scientific medicine?

Now that the age of philanthropy is passing, how are hospitals to be supported?

Is insurance—three cents a day—or direct use of tax funds the answer?

Should the United States have a Ministry of Health and set up a Federal Department of Health in the President's Cabinet?

The opinions as expressed by the various contributors are assembled into eleven sections. The first seven analyze, rather critically, what is right and what is wrong with American Medicine to-day.

The first four sections discuss various proposals for distributing medical care and lowering its cost, and for organizing medical care and public health services.

The opinions represent a cross-section of substantial thought which, when amalgamated, should be of great assistance in crystallizing the fundamental principles involving the most important socio-economic activity of all human relations.

Medical services should be of the highest type, available to all, and—what is especially important is—a just reward to all members of the medical profession who have contributed hundreds of millions of dollars' worth of free services annually with the consequences that the desirable standard of living of the doctor and his family was needlessly sacrificed. No one can impugn the contributions of the medical profession, now is the time to make adjustments and who can co-operate more efficiently than the well informed, impartial, intelligent physician?

This work should be read by every physician, by every sociologist, by every economist, and by every industrialist. It is broad in scope, well classified, and pleasant to read—and how instructive!

TRAITE DE CHIRURGIE ORTHOPEDIQUE. By L. OMBREDANNE and P. MATHIEU. Volumes IV and V. Published by Masson et Cie., Paris, 1937. Price, for five volumes, complete, 1250 francs.

Volumes IV and V of this work conclude the series. These two volumes are for the most part devoted to a discussion of the conditions affecting the pelvis and lower extremities. These are adequately covered and, in our opinion, emphasis is well distributed over the various types of lesion, both traumatic and otherwise. The more modern methods of treatment of fractures are well discussed, that of the hip being well presented from all angles, both as to the treatment of the acute fracture and to the treatment of the pseudo-arthritis or "non-union," as it is more commonly known in this country.

Other types of hip lesion are well discussed beside the fractures, excellent discussions being presented on the subjects of congenital dislocation, coxa vara, coxa valga, coxa plana, traumatic dislocations, acute arthritis and gonorrheal arthritis, coxalgia (tuberculosis),

snapping hip, and arthritis deformans of the hip. All of these subjects are excellently portrayed, both as to etiologic factors involved and as to the more modern methods of treatment.

In the same volume is found a discussion of the various lesions involving the knee joint. In our opinion this joint is not as adequately treated as the hip joint, none of the sections being as thorough or up-to-date in their viewpoint as those which we have already pointed out so adequately cover the various lesions of the hip.

In the last volume we find the lower leg and foot well presented, their various lesions both congenital and post-traumatic as well as those due to disease being discussed. Following this there is a section on amputations in which various types of amputation are presented and their complications, together with a brief review of cinema plastic amputations and prosthesis.

Finally considerable space is devoted to the more acceptable types of tendon transplant, both for the upper extremity and for the lower extremity as well. A brief résumé of surgical procedures used in the treatment of spastic paralysis, a chapter on equalization of leg length, both by actual lengthening and shortening operations and by epiphyseal operations is given. Finally, a chapter on the question of disability ratings in traumatic lesions is given.

We feel that the authors have made of this, the first extensive treatise published on orthopedic surgery, a most excellent work. They have brought orthopedics up-to-date, showing the type of orthopedic work done in the more advanced orthopedic clinics the world over. For the most part, emphasis is placed on the types of treatment used which will make the work appeal more to the practical minded. Some will be disappointed that their pet methods of treatment or points of view regarding etiology are not discussed, but on the whole, we believe, the authors have done an excellent job of selection of material and have presented it in a most acceptable form.

The form and style are excellent and the reproduction of photographs and roentgenograms is equally good.

We believe the treatise will find a wide field of usefulness.

SOME FUNDAMENTAL ASPECTS OF THE CANCER PROBLEM. Symposium sponsored by the Section on Medical Sciences of the American

Association for the Advancement of Science, Atlantic City, N. J., Dec. 29, 1936, to Jan. 1, 1937, edited by Henry Baldwin Ward. Occasional Publications of the American Association for the Advancement of Science, No. 4, June, 1937, supplement to Science, Vol. 85, 248 pages. Published by the Science Press, New York City, 1937. Price: cloth bound, \$2.50, paper bound, \$2.00.

This publication of a symposium on cancer held at the Atlantic City Meeting of the American Association for the Advancement of Science in its Section on Medical Sciences shows how diversified is the field of cancer research, and how diversified are the results and opinions of workers in this field. It can be read with interest and profit by all those who concern themselves with any of the various aspects of malignant disease.

SIEBZEHN JAHRE STRAHLENTHERAPIE DER KREBSE. Zürcher Erfahrungen, 1919-1935, by HANS R. SCHINZ and ADOLF ZUPPINGER. A volume of 340 pages, 95 figures, 213 tables. Published by Georg Thieme, Leipzig, 1937. Price: paper RM 32, bound RM 34. Less 25 per cent in U. S. A.

This monograph is a detailed statistical analysis of all of the 2,529 cases seen in the Universitäts Klinik, of Zurich, with special reference to survival of the various tumor groups after treatment. As was the case with practically all radiotherapeutic departments Schinz' earlier experience also was with the treatment of far advanced cases (in the total group treated only 24 per cent were operable). Statistically it is proven that with earlier diagnosis and earlier reference of the patients for radiotherapy, together with improvements and refinement of radiotherapeutic technic, the results are better. At present, protracted-fractional low intensity roentgen therapy (protrahiert-fraktionierte Röntgenlangbestrahlung) and telerradium therapy (Fernurietherapie) are the methods of choice in Schinz' clinic. The illustrations of the various steps of involution of tumors during treatment are well chosen, and, as is usual with all Thieme's publications, well reproduced. This book can be recommended to all radiotherapists who may be interested in finding out what one of the foremost European clinics is accomplishing in the treatment of malignant disease.

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S. M. ATKINS, M.D., of Waterbury, Conn.	E. T. LEDDY, M.D., of Rochester, Minn.
S. RICHARD BEATTY, M.D., of Madison, Wis.	ERNST A. POHLE, M.D., Ph.D., of Madison, Wis.
J. E. HABBE, M.D., of Madison, Wis.	CHARLES G. SUTHERLAND, M.B. (Tor.), of Rochester, Minn.
HANS W. HEFKE, M.D., of Milwaukee, Wis.	
L. G. JACOBS, M.D., of Madison, Wis.	

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ADDISON'S DISEASE

Calcification of the Adrenal Capsules. H. Tillier and Huguenin. *Bull. et Mém. Soc. Radiol. Méd. de France*, February, 1937, 25, 135, 136.

Roentgenograms of the renal regions in a case of Addison's disease demonstrated calcification of the adrenals confined largely to the cortex. The authors point out the value of the three-quarters view.

S. RICHARD BEATTY, M.D.

ANIMAL EXPERIMENTATION

New Demonstration of a Reduced Regenerative Power of Tissue Following Roentgen Irradiation. B. Dahl. *Strahlentherapie*, 1937, 58, 482.

The author studied the behavior of skin in rats following the application of erythema doses of roentgen rays. The capillaries were tested by the application of 50 per cent mustard oil and the healing tendency of the skin after producing a burn by means of a cautery. Young rats were used in the experiments, and the skin was studied both macroscopically and microscopically. Following a light degree of dermatitis, the hair reappeared completely and there were no adhesions in the subcutaneous fascia. The capillaries also appeared normal; however, their ability to dilate was definitely decreased. In the granulation tissue in the ulcers produced by the cautery there was definitely less vascularization although the ulcers healed. In cases in which the skin had shown higher degrees of dermatitis, permanent alopecia and slight atrophic changes were observed, with adhesions in the subcutaneous fascia. The capillaries dilated less and the skin was less resistant toward heat, but in this instance also the ulcers produced by the cautery healed after a slight delay.

ERNST A. POHLE, M.D., Ph.D.

APPARATUS

A Completely Protected High Tension Radiodiagnostic Apparatus. M. Delacour. *Bull. et Mém. Soc. Radiol. Méd. de France*, January, 1937, 25, 76-80.

To fill the need for a completely shock-proof unit of great capacity there has been developed the "Multitravail" unit designed to supply a number of radiographic or fluoroscopic tubes through shock-proof cables.

The high tension transformers, valve tube transformers, and four-valve tubes are contained in an oil-filled metal case. Above this in the same unit are the special high tension switches operated electro-magnetically by relays through a special switch block, for supplying the current to the various x-ray tubes. The regulating controls and meters are all included in a separate unit, the "Synchro-pupitre," which contains the Synchro-contacter.

The apparatus is equipped with autocompensators for the kenetron filaments and a stabilizer for the x-ray tube filaments.

The arrangement of the circuits with resistances in series with the current to each filament transformer, makes damage from surges almost impossible.

The unit is capable of delivering 500 ma. at 95 kv.p. for instantaneous exposures. Oscillographic studies show that there is no tendency to surges; the tension is maintained evenly throughout the exposure.

S. RICHARD BEATTY, M.D.

Presentation of Some Planigraphs. M. Buffé. *Bull. et Mém. Soc. Radiol. Méd. de France*, January, 1937, 25, 83-85.

The production of x-ray films of single planes of the body by moving the tube and films in opposite directions about an axis at the level of the chosen plane has been completely discussed by others. In principle, the images of the other planes are effaced by blurring.

The advantages of such films are evident, as in the study of the thoracic contents, the skull, and the joints. The least possible penetration should be used for better contrast. It may be necessary to increase this for study of the lung at one or two meters to avoid prolonged exposure times.

Two types of apparatus have been employed. In one, the tube and film move in opposite directions in the same axis; in the other, the movement of both is spiral. The latter is preferred for the study of bone because the detail is maintained in only one direction with the first.

The method has many advantages and should be more generally employed.

S. RICHARD BEATTY, M.D.

A Radiotherapy Installation of 200,000 Volts, 25 Milliamperes. M. J. Massiot. *Bull. et Mém. Soc. de Radiol. Méd. de France*, January, 1937, 25, 17-22.

The author describes a 200,000-volt installation with oil-immersed, center-grounded transformers, oil-cooled target, shock-proof cables, and valve tube rectification which functions at 25 milliamperes. The control panel is equipped, in addition to the usual instruments and controls, with circuit breakers which function when the flow of oil to the target ceases, a device preventing the sudden imposition of high voltages across the tube, and circuits permitting the oil pump to function on either of two lines in case one fails to provide current.

Another generator equipped with condensers permits a constant tension of 18 milliamperes.

Tables are given comparing the surface doses, depth doses, and times for the attainment of 1,000 r depth dose for various tubes for pulsating and constant potentials and for different field areas.

S. RICHARD BEATTY, M.D.

The "Intenssol Lamp." S. Lomholt. *Strahlentherapie*, 1937, 59, 383.

There has been built a water-cooled quartz mercury vapor lamp with a vapor-pressure of 100 atmospheres and more. The arc is housed in a small tube of 10 mm. length and 2 mm. diameter. It has been briefly described before by van der Plaats (*Strahlen-*

therapie, 1926, 56, 497). The author reports in this paper in detail the results of his physical, biological, and clinical investigations. A device for concentrating the ultra-violet radiation and applying it under compression is also described. The skin reactions were studied both macroscopically and microscopically. These preliminary observations seem to indicate that the new lamp is superior to the Finsen lamp in the treatment of neurodermatitis.

ERNST A. POHLE, M.D., Ph.D.

Apparatus for the Accumulation of Energy for the Utilization of High Tension for Instantaneous Exposures. P. Lorimy. Bull. et Mém. Soc. Radiol. Méd. de France, January, 1937, 25, 64-66.

An accessory apparatus has been developed, which when placed in the circuit between the current source and the high tension generator, makes it possible to develop very high tension for short exposures. A monophasic alternator of low internal resistance furnished with a heavy fly wheel and driven by an electric motor makes it possible to utilize the kinetic energy for generation of high tensions.

Exposures of the order of $\frac{1}{100}$ seconds at 30-60 kv.a. are possible with variations of only 1 per cent in time and 10 per cent in the resistance of the alternator.

It is possible to utilize the apparatus over a wide range of fluoroscopic and radiographic requirements through a simple system of controls.

S. RICHARD BEATTY, M.D.

BIOLOGIC EFFECTS OF RADIATION

The Therapeutic Value of the Biologic Destructive Action of Roentgen Rays. Edmondo Ingber. Archivio di Radiologia, 1936, 12, Nos. 3-4, 244-254.

This address, in memory of Guido Holzknecht and Fritz Pordes, is well worth reading in the original.

E. T. LEDDY, M.D.

BONE DISEASES (DIAGNOSIS)

Squamous Epithelial Bone Cysts of the Terminal Phalanx. A. D. Bissell and Albert Brunschwig. Jour. Am. Med. Assn., May 15, 1937, 108, 1702-1704.

It is generally stated that such cysts are of traumatic origin and are due to proliferation of a small fragment of cutaneous epithelium that is carried into the deeper tissues. That such epithelial cysts not only occur in the soft tissues but may also extensively involve the phalanges is shown by reports in the literature. An adequate history of trauma was found in only a proportion of reviewed cases, but the evidence in their own cases favored traumatic deep implantation of a fragment of cutaneous epithelium as a more probable etiologic factor than displaced embryonic rests.

Non-malignant stratified squamous epithelium may invade bone under other circumstances. (1) The squamous epithelial lining of dentigerous cysts is the

result of downgrowth of gingival mucosa along the sinuses, sometimes present between the gingival surface and the cyst cavity. (2) Chronic osteomyelitis cavities in the long bones may become partially or completely lined by downgrowth of the cutaneous epithelium along the draining sinuses. In tuberculosis of the calvarium, small cavities within the diploe may present an epithelial lining, also the result of downgrowth of the cutaneous epithelium of the scalp along open sinuses. From a review of the reported cases the authors felt the following clinicopathologic entity might be described:

Traumatism to the distal portions of the fingers may be followed shortly or after a prolonged period by progressive, slightly or markedly tender diffuse swelling of the distal phalanx without other evidence of infection. Also, such symptoms may develop in the absence of a history of trauma. In the roentgenogram a central expanding cystic lesion of the terminal phalanx is seen that has destroyed a portion or almost all of the bone. These are frequently interpreted as chondromas. At operation a cyst is found that is easily peeled away from the surrounding bone. This cyst contains sebaceous material and is lined by squamous epithelium. The lesions are benign, but recurrences may develop if removal is incomplete.

Pre-operative differentiation from solitary bone cyst, giant-cell tumor, or chondroma is not possible. The treatment of choice is surgical excision.

CHARLES G. SUTHERLAND, M.B. (Tor.).

Metastasis in a Bang's Infection. F. Hart Horstmann. München. med. Wchnschr., June 18, 1937, 84, 984, 985.

This is a case report describing a man, aged 41, in whom a Bang's infection (brucellosis with *B. abortus*) produced a localized osteomyelitis and bone abscess in an osteoma of the left thigh. Spontaneous resolution of the process took place.

L. G. JACOBS, M.D.

Localized Transverse Lines at the Metaphyses of Long Bones. N. R. Braun. Röntgenpraxis, November, 1936, 8, 746.

Transverse lines of increased density at the metaphyses of long bones are known to occur after different systemic diseases, as pneumonia, typhoid fever, rickets, hyperthyroidism, etc. They are then found more or less generalized in most all of the long bones. The localized occurrence of these dense lines of increased calcium content is rare. It is apparently due to exogenous causes, mostly rickets, in combination with local irritation, such as deformities or fractures.

HANS W. HEFKE, M.D.

Brittle Bones and Blue Scleras. Editorial. Jour. Am. Med. Assn., May 8, 1937, 108, 1657, 1658.

Four distinct features characterize this clinical

entity: blue scleras, fragile bones, a tendency to deafness, and marked relaxation of the ligaments. The disease follows the mendelian laws of inheritance, appearing as a dominant character. Hills and McLanahan (Arch. Int. Med., January, 1937, 59, 41) present a detailed consideration of the etiology, pathologic changes, and treatment in a case which they report. Data were gathered on 51 other members of the same family. The family tree shows the appearance of characteristic signs of the syndrome in 27 of the 51 family members. The pathology and hereditary features of this disease have been comprehensively treated by Key (Arch. Surg., October, 1926, 13, 523) and by Bell (in Pearson, Karl: Treasury of Human Inheritance, Cambridge University Press, London, 1928, vol. 2, pt. 3, sect. 24).

CHARLES G. SUTHERLAND, M.B. (Tor.).

BREAST CANCER

Simple Post-operative Radiation Therapy of Cancer of the Breast with High, Fractionally Applied Total Dose. F. Melchart. Strahlentherapie, 1937, 59, 312.

In 1932 the author treated 50 patients after surgical removal of a breast cancer with one series of treatments and reports now his preliminary results at the end of a four-year period. The entire breast region, including the supraclavicular area and axilla, was irradiated. The single doses varied from 180-240 r per day at 6-24 r/min., with total doses of 2,400-4,700 r. Forty-seven patients completed the prescribed series of treatments. The clinical data are presented in tabulated form; the classification of Steintal has been adopted. At the end of four years, six out of eight patients (Stage I), 11 out of 17 patients (Stage II), and 3 out of 25 patients (Stage III) were alive. None of the cases showed fibrosis of the lungs.

ERNST A. POHLE, M.D., Ph.D.

My Method of So-called Prophylactic and Curative Post-operative Irradiation in Carcinoma of the Breast. G. C. Palmieri. Strahlentherapie, 1937, 59, 298.

The author describes his method of post-operative x-ray therapy in carcinoma of the breast by means of a "paraffin filter" which serves as a source of scattered radiation. He claims that the total treatment time is considerably reduced with this equipment and that the depth dose 3-5 cm. below the skin compares well with those which have been obtained at focal skin distances of 70-80 cm., but requires four times the time. The clinical material is too small to draw final conclusions as to the end-results.

ERNST A. POHLE, M.D., Ph.D.

CANCER (DIAGNOSIS)

Development and Differential Diagnosis of Bronchial Carcinoma. Walter Naumann. Röntgenpraxis, March, 1937, 9, 152-160.

The author reviews the roentgenological aspect of 74

cases of bronchial carcinoma, seen during a span of ten years. He divides all cases into two groups.

In the first group there is no evidence of the tumor as such at first; atelectasis and occasionally disturbances in the movement of the diaphragm are the only signs. The so-called mediastinal wandering was seen in only two cases. At times glandular metastases are the first sign of a malignant tumor of the lung.

In the second group the tumor can be seen as such because it has infiltrated the lung itself.

In only nine of the 74 cases the so-called hilus carcinoma was seen, while in 35 cases either an entire lobe or large portions of one were involved. Pleuritic effusions were seen only in advanced stages.

The differential diagnosis from other diseases of the lungs is considered. The progress of bronchial cancers is usually not influenced by therapeutic radiation. The author saw occasionally temporary clearing of an atelectasis. About 20 per cent showed a noticeable, even though only temporary, improvement.

HANS W. HEFKE, M.D.

Biologic Properties of the Blood in Cancer. M. Ascoli. Le Cancer, 1935, 12, 266-270.

A greater quantity of lipoids rich in unsaturated valences can be extracted from the serum of cancerous patients than from normal serum when these sera are dried on filter paper and extracted with cold ether. The author calls these "disposable" valences. He defines a "disposability quotient" between the total unsaturated valences in an alcohol-ether (hot) extract of dried serum and these disposable valences which is in the neighborhood of six in normal states and even in disturbances of the lipoid metabolism as in nephrosis. In cases of malignancy only the "disposable valences" increase and the quotient becomes two. This disturbance is found not only in the serum but also in the corpuscular part of the blood, and the tissues in general.

It is possible to produce this modification in animals by endoperitoneal injection of tar or benzopyrene.

Several other phenomena produced by the presence of these "disposable valences" are described. The glycolytic powers of cancerous blood cells are above normal. This effect can be produced *in vitro* by adding sera or organ extracts of cancerous individuals or tumor extract to normal blood cells.

The best method of demonstrating the change in ratio of "disposable valences" is by means of determination of the iodine number. The results have been confirmed in the gynecologic and urologic fields by others.

S. RICHARD BEATTY, M.D.

Acute Syndromes of Metastasis. René Huguenin. Le Cancer, 1935, 12, 213-226.

Not usually, but quite frequently, the dissemination of metastases from a malignancy is accompanied by acute symptoms, which may simulate the syndromes of other clinical entities. The author cites three classes of such syndromes: the abdomino-hepatic, in which

metastases may give the clinical picture of peritonitis, cholecystitis, liver abscess, etc., with sudden and severe fever, pain, and vomiting which may lessen or disappear within a few days to be followed by the usual symptoms of metastatic malignancy; *the neurologic syndromes*, simulating encephalomalacia or cerebral accident; *the pulmonary syndromes* in the forms of pneumonia, pleurisy, or tuberculosis, especially as the nodules are not always visible radiographically early.

That these syndromes occur so suddenly and are so frequently associated with alterations of the vascular beds is an important hint as to the etiology of metastasis.

The clinician, especially in caring for those patients known to have cancer or to have had a cancer believed cured, must keep these syndromes in mind to avoid making false diagnoses and prognoses.

S. RICHARD BEATTY, M.D.

Diagnosis and Progressive Changes of Bone Metastases in a Clinically Not Diagnosed Case of Cancer of the Thyroid. R. Finsterbusch and G. Schumann. *Röntgenpraxis*, November, 1936, 8, 735.

The records of the University Clinic of Leipzig of 50 cases of cancer of the thyroid showed bone metastases in 8 per cent of these cases. A very interesting case is described in which the primary tumor was never diagnosed clinically. Extensive radiological changes were observed in the pelvic bones over a period of nine years. They were diagnosed as metastases only shortly before the death of the patient. The appearance of these large lesions was that of an osteitis cystica. It changed very little in size during the course of eight years. Other bone metastases were later found in skull, scapula, and spine.

HANS W. HEFKE, M.D.

Color of Hair and Eyes in Cancer Patients. E. Beuster. *Strahlentherapie*, 1937, 59, 282.

The author recorded the color of hair and eyes in 500 patients with cancer as compared with 500 controls. Light hair and light eyes were found in the majority of cases with carcinoma of the skin, esophagus, and the jaw. This preponderance was not noted in women with carcinoma of the genital organs, the breast, nor in carcinoma of the larynx.

ERNST A. POHLE, M.D., Ph.D.

Cancer of the Sub-hepatic Regions. J. Pelnar. *Le Cancer*, 1935, 12, 227-237.

Carcinomas of the gall bladder, of the extra-hepatic bile ducts, of the ampulla of Vater, of the head of the pancreas and a certain number of those of the body of the pancreas, considered as a group, occur almost as frequently as cancer of the stomach, being found in a ratio of 13.5 per thousand autopsies as compared with 16 per thousand for carcinoma of the stomach. They are rapidly fatal and early diagnosis is necessary. As a group, they have in common a series of important

symptoms and signs which should make it possible to suspect their existence in the initial stage.

From his personal experience (90 cases), the author outlines the symptomatology of this group of carcinomas and suggests the diagnostic procedures useful in confirming a diagnosis. The symptomatology is given in tabular form.

S. RICHARD BEATTY, M.D.

CANCER (THERAPY)

Radiation Treatment of Carcinoma of the Buccal Cavity. Richard Dresser and Charles E. Dumas. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1936, 36, 939-944.

While in some clinics carcinoma arising from the tissues of the mouth has come to be considered a radiation therapy problem entirely, the writers' opinion is that a small well localized lesion in the anterior floor of the mouth is better handled by adequate resection. For intra-oral roentgen radiation of mouth lesions, special lead cones have been devised, the lower part of the special cone being of several sizes to permit appropriate inclusion of the field of the tumor, depending upon its size. By this device the distance from target to tumor is fixed at 25 cm. Single doses of from 1,500 to 2,000 r at 200 kv., with 0.5 mm. copper were thus administered directly to the tumor if a small lesion, or larger doses are given by dividing the dose. Cross-fire of the tumor by neck radiation supplements the intra-oral treatment.

Four hundred r given daily for a week for a total dose of 2,400 r accomplishes much the same clinical results and the same skin and membrane reactions as 200 r daily for three weeks for a total dose of 4,000 r. If about four weeks after 2,400 r is given in a week, the tumor masses show satisfactory regression, 400 to 1,200 r is given in from two to three days and this may be repeated once again after another three to four weeks. When the cervical glands become fixed, indicating invasion beyond the capsule, permanent regression cannot be accomplished.

Repetition of the above dosage should not be repeated even after several years. Neither should attempts be made to surgically excise glands from tissues so irradiated, since such tissues have very poor resistance against infection.

J. E. HABBE, M.D.

Direct Roentgen Irradiation of Deep-seated Tumors. Sherwood Moore. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1936, 36, 969-979.

The author argues strongly for distinct modifications of the accepted methods of radiation therapy of malignancies when these are accessible to surgical exposure. He points out that most failures are brought about by under-dosage due to fear of ill-effects in the overlying skin or membranes. He also expresses the opinion that roentgen sickness is largely attributable to action of x-rays upon the skin. The method employed is to have

the tumor exposed surgically with the skin flaps carefully sutured back and protected against all radiation by lead foil. The tumor is then immediately radiated, often with the patient under anesthesia. Both low voltage (85 kv.) without filter, and moderate voltage (160 kv. constant potential), with 0.25 mm. copper filter have been the technics employed. Metastatic carcinoma in the glands of the neck, in the axilla, and primary carcinoma in the base of the bladder, carcinoma of the lung, the rectum, and tumors of the brain have been so treated with single doses varying from 1,000 to 5,000 r. Immediately following the x-ray treatment the surgical wound is closed and prompt healing without complications has been the rule.

Sufficient good results from surgically inoperable cases have been obtained to justify continuance of the method.

J. E. HABBE, M.D.

Advanced Cancer of the Head and Neck. Charles L. Martin. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1936, **36**, 954-962.

In the treatment of advanced carcinomas of the head and neck the experiences of the writer proves the value of heavy filtration as advocated by Merritt and Rathbone, with intensity being a less important consideration, although the best results occurred when rates of 12-16 r per minute were used. When using 0.75 mm. copper plus 1.0 mm. aluminum, the following total doses are considered the top of safe limits according to the size of the field: 4,200 r for 7 cm. in diameter, 3,600 r for 15 cm. in diameter, and 2,800 r for 20 cm. in diameter.

At times the external x-radiation is augmented by radium needles implanted into the gland secondaries, such treatment usually being given for from five to seven days just preceding the external series.

The writer warns against any such modified Coutard technic for cases showing skin tanning from previously administered massive doses of x-rays.

J. E. HABBE, M.D.

Radiotherapeutic Experiences with Malignant Tumors of the Upper Respiratory and Digestive Tracts Complicated by Regional Lymph Gland Metastases. A. Pagani. *Strahlentherapie*, 1937, **59**, 441.

The author analyzed the cases with tumors of the lip and oral cavity accompanied by metastases in the lymph glands which had been observed during the period 1919-1935. After a careful study of 88 patients seen during that period he offers certain conclusions. The treatment of the glandular area in these cases is indicated only if the local tumor has been or can be eradicated. If no lymph glands are involved he recommends, especially for primary tumors in the anterior part of the tongue, a prophylactic series of x-ray therapy applied according to the fractional dose method. In cases with small local tumors which can be cured by radium application any suspicious but still operable lymph glands should be removed. If histological ex-

amination shows invasion, they should be irradiated following operation. The same doses should be used in such cases as if the operation had not been performed.

More advanced cases may be treated by simple fractional doses or by the protracted fractional dose method. If in these patients the local tumor disappears and some of the involved glands remain after treatment, they should be removed. The end-results of this series of cases, or all with involvement of lymph glands in the beginning of the treatment, were 15 per cent for a three-year period and 10 per cent for a five-year period. The results of the protracted fractional roentgen therapy were approximately the same as of the combined radiosurgical therapy. The final outcome depends not only on the size of the primary tumor but also on the amount of metastases. So far, no single case of intra-oral carcinoma with involved lymph glands attached to the underlying structures could be permanently cured.

ERNST A. POHLE, M.D., Ph.D.

Prophylactic Post-operative Irradiation. H. R. Schinz. *Strahlentherapie*, 1937, **59**, 291.

The author undertook an evaluation of the post-operative irradiation in carcinoma of the breast and cervix. If this is done systematically he believes that post-operative radiation therapy definitely improves the end-results.

ERNST A. POHLE, M.D., Ph.D.

Post-operative Radiation Therapy in Cancer. H. Wintz. *Strahlentherapie*, 1937, **59**, 305.

The author analyzes the problem of post-operative radiation therapy in patients with carcinoma. He wishes to make a definite distinction between post-operative irradiation in cases with incomplete operation, irradiation of post-operative recurrences, and true prophylactic radiation therapy. The latter comprises those cases in which radiation therapy is given in order to prevent a recurrence following complete surgical removal of tumors. Up to this date there seems to be no evidence proving that prophylactic radiation therapy can prevent the development of cancer. The author also gives his reasons for preferring pre-operative irradiation to radiation therapy following operation. His statistics for carcinoma of the breast seem to show that the results are better if irradiation is applied before surgical removal of the tumor.

ERNST A. POHLE, M.D., Ph.D.

Critical Remarks Regarding Prophylactic Post-operative Radiation Therapy. W. Altschul. *Strahlentherapie*, 1937, **59**, 340.

The author discusses the value of post-operative radiation therapy. He wishes to distinguish the true prophylactic irradiation from the post-operative irradiation for recurrences. Practically, this is not always possible because one cannot definitely say whether active or dormant cancer cells are left in the area operated upon.

He proposes, therefore, to give post-operative irradiation therapy in two stages: first the entire tumor area, at the same time shielding the regional lymph glands, and three or four weeks later irradiating all regional lymphatics.

ERNST A. POHLE, M.D., Ph.D.

Treatment of Malignant Tumors of the Larynx and Pharynx. E. Wessely. *Strahlentherapie*, 1937, **58**, 641.

The author briefly reports his experience with the Coutard method in the treatment of 174 cases of carcinoma of tongue, epiglottis, hypopharynx, and larynx. While he is not prepared yet to present statistics based on five-year survivals, he feels that this treatment method offers a chance to patients whose lesions have become inoperable.

ERNST A. POHLE, M.D., Ph.D.

Experiences with the Low Voltage Therapy in Skin Carcinoma. H. Quastler. *Strahlentherapie*, 1937, **59**, 182.

The author gives a brief preliminary report regarding six patients with carcinoma of the skin treated by Chaoul's method. He used 70 kv., 0.25 mm. Al, single doses of from 300 to 500 r and total doses of from 5,200 to 10,000 r. In some cases he alternates the low voltage technic with radiation of higher penetration. The immediate response to the treatment method was very satisfactory although no final conclusions can be offered at this time.

ERNST A. POHLE, M.D., Ph.D.

THE COLON

Meckel's Diverticulum. Howard K. Gray and James W. Kernohan. *Jour. Am. Med. Assn.*, May 1, 1937, **108**, 1480-1483.

This is a report of a case of Meckel's diverticulum associated with intussusception and adenocarcinoma of ectopic gastric mucosa in a married woman, aged 37.

That there is a persistence of the proximal end of the yolk stalk to form a pouch at its point of union with the intestine in approximately 3 per cent of all individuals has been widely recognized. This pouch is usually referred to as "Meckel's diverticulum" and is a structure of clinical importance because of the rôle it may play in producing intestinal obstruction. Benign ulcerating processes in ectopic gastric mucosa have been described with relative frequency and have been incriminated occasionally as the source of intestinal hemorrhage. The development of malignant lesions in the ectopic gastric mucosa of a Meckel's diverticulum is extremely rare.

Roentgenographic examination of the colon in this patient revealed a filling defect involving the ileocecal region at a point that coincided with the position of a palpable mass. The changes suggested an extraluminal mass. Surgical investigation elicited an intussusception of the terminal portion of the ileum, about 35 to

40 cm. above the ileocecal juncture. A portion of bowel that had become invaginated for approximately 8 cm. was easily reduced. The ileocecal region was essentially normal. A second intussusception had occurred in a portion of tissue, which appeared to be a large Meckel's diverticulum. At the tip, a portion of the mesentery of the diverticulum had become intussuscepted into the bowel. It was impossible to reduce this, and a segmental resection of the ileum was performed by making an end-to-end anastomosis.

Examination of the tissue removed demonstrated heterotopic gastro-intestinal tissue, chronically inflamed, occupying the entire middle third of the diverticulum, and this portion gradually merged into the distal third, which was the site of an adenocarcinoma. There was a gradual transition between the heterotopic gastric mucosa and the carcinoma at the tip.

CHARLES G. SUTHERLAND, M.B. (Tor.).

Comparison of Methods of Roentgen Examination of the Colon. James T. Case. *Jour. Am. Med. Assn.*, June 12, 1937, **108**, 2028-2034.

Routine practice in intestinal x-ray examinations includes the opaque meal, with appropriate screen or film observations of the opaque residues as they move along the large bowel, followed by the contrast enema administered under screen control by the physician radiologist himself, with appropriate film records during the course of the fluoroscopy, and subsequent observations after the patient has attempted to expel the contrast fluid. The combination of these two series of observations constitutes a complete gastro-intestinal roentgenologic study.

On the whole, it may be said that the colonic study with the opaque meal gives information more especially regarding function, whereas the contrast enema affords data relating to organic lesions, the two methods overlapping somewhat in their usefulness and yet often supplementing each other in a very precise manner. The opaque meal is time-consuming, whereas the contrast enema or some elaboration of it can be accomplished within a short time. The presence of such a condition as anal insufficiency may necessitate the use of the barium meal study even though the contrast clyisma would be the method of preference. There is also use for the oral contrast method, preferably by the use of umbrathor, in cases in which the contrast enema has revealed a serious obstruction and the radiologist does not wish to force passage of the stricture and yet wishes to obtain information regarding the digestive tube proximal to the stricture.

The single contrast enema, employed under roentgenoscopic control, is the most expeditious, simple, convenient and generally useful method of study of colonic morphology. It should be administered by the roentgenologist at a rate sufficiently slow to allow adequate screen study and such fluororadiographic film records as seem required.

Fischer, in 1923, popularized the idea of the double contrast method, combining the contrast enema with

air insufflation of the colon. The next stage of technical progress in colonic investigations was the development of methods for showing the internal mucosal relief of the digestive organs originated by Forssell. Weber, Gershon-Cohen, and others have led in re-establishing interest in air injections of the colon following the barium sulfate enema and have brought the "combined method" or "double contrast method" to a high stage of refinement in technic and interpretation in the search for some means of making an earlier diagnosis of carcinoma of the colon, in differentiating various types of colitis, and particularly for the discovery of small polypoid growths and mucosal alterations.

CHARLES G. SUTHERLAND, M.B. (Tor.).

CONTRAST MEDIA

The Use of Thorium Dioxide in the Roentgenographic Study of Liver Abscess. Robert J. Reeves. *Am. Jour. Roentgenol. and Rad. Ther.*, December, 1936, **36**, 923-927.

While it must be remembered that thorium dioxide, when injected into the blood stream and fixed in the liver and spleen by the reticulo-endothelial cells, emits small quantities of high energy radiation comparable to that of gamma rays of radium, it has not been found to produce clinical manifestations of late ill effects in patients who have submitted to the injection as long ago as seven years. If there is clinical suspicion of metastatic malignancy in the liver, or of liver abscess, the use of the drug is considered justified. Ordinarily the entire dose of 75 c.c. of thorium dioxide suspension diluted with 100 c.c. salt solution is given at a single dose intravenously and films are taken five days later. Six cases of liver abscess, localized by means of this procedure, are presented.

J. E. HABBE, M.D.

Potential Hazards of the Diagnostic Use of Thorium Dioxide. Editorial. *Jour. Am. Med. Assn.*, May 8, 1937, **108**, 1656, 1657.

When injected into a vein thorium dioxide sol remains indefinitely in the reticulo-endothelial system, especially in the liver and spleen. The immediate utility of colloidal thorium dioxide preparations has tended to obscure an important characteristic of this substance: its radio-activity. Because patients who have received injections of this compound have shown no apparent ill effects over a period of years, some clinicians conclude that the preparation is safe and have begun to employ it with less caution.

The degradation products of thorium emit alpha rays more penetrating than those of the radium series. This ray is about 10,000 times as toxic to tissues as the gamma ray which is used therapeutically. The alpha rays are filtered out in therapeutic use of radium and their effects are seen only when the material comes into direct contact with tissues, as on ingestion or injection. An amount commonly used for intravenous injection

of one of the commercial preparations of thorium dioxide has an alpha-ray activity equivalent to that of from 1.5 to 3 micrograms of radium.

Experience with radio-active intoxication indicates that as much as ten or fifteen years (and perhaps longer) may elapse between ingestion of the active material and the onset of gross tissue changes.

CHARLES G. SUTHERLAND, M.B. (Tor.).

DEEP THERAPY

A Year's Experience with 800 kv. Roentgen Rays. Howard E. Ruggles. *Am. Jour. Roentgenol. and Rad. Ther.*, September, 1936, **36**, 366, 367.

From 300 patients treated the conclusion drawn is that there is no improvement in the primary results over that of 200 kv.

S. M. ATKINS, M.D.

Comparative Clinical Value of Supervoltage Roentgen Therapy. T. Leucutia. *Am. Jour. Roentgenol. and Rad. Ther.*, September, 1936, **36**, 350-365.

The advantage of this voltage lies in the better distribution and the creation of more advantageous absorption conditions within the tissues irradiated.

S. M. ATKINS, M.D.

GALL BLADDER (NORMAL AND PATHOLOGIC)

The Stoneless Gall Bladder. Carl A. Kunath. *Jour. Am. Med. Assn.*, July 17, 1937, **109**, 183-187.

This is an analysis of 100 cases treated by cholecystectomy. Compared with a similar series of cases in which stones were present, the stoneless cases showed a greater morbidity, a higher post-operative mortality, and only about half as many cures.

The stoneless cases were analyzed carefully from the standpoint of cholecystographic evidence and also pathologic changes present in the gall-bladder wall, but little help was offered from either of these sources in regard to prognosis following cholecystectomy. In general, the end-results tended to be better as the pathologic changes became more marked; but there are many queer aspects which are difficult to reconcile.

An analysis of the pre-operative symptoms revealed cure of colic in 86 per cent of cases in which it was present. Cures of dyspepsia were only 33 per cent. Of the patients who did not complain of dyspepsia prior to operation, 38 per cent had such symptoms after operation. This would seem to be a strong argument in favor of the view that the dyspepsia syndrome is related not so much to disease of the gall bladder as to non-function of the gall bladder.

Although a few poor results could possibly be ascribed to residual pathologic changes in the pancreas, liver, or bile ducts, it was not possible to incriminate definitely any of these organs.

Errors in diagnosis, duodenal ulcer, duodenal diverticulum, a tuberculous spondylitis and a chronic gono-

coccic peritonitis, irritable intestine, and spastic conditions of the gastro-intestinal tract (in by far the majority) explained the poor results.

The great majority of unimproved cases had to be explained on a basis of physiologic changes or altered function. There was probably a large group of cases in every series of stoneless gall bladders lying on the borderline between organic and functional disease; these were the cases in which diagnosis was difficult and in which cholecystectomy was apt to be disappointing.

The hope for improvement in the treatment of the stoneless gall bladder appeared to depend on a better understanding of the physiology of the biliary tract.

CHARLES G. SUTHERLAND, M.B. (Tor.).

Cholesterosis of the Gall Bladder. Editorial. Jour. Am. Med. Assn., June 12, 1937, 108, 2042, 2043.

The preponderance of experimental proof seems to indicate that the gall bladder absorbs cholesterol from the bile and that the cholesterosis is probably an infiltrative process. Infection, though frequently associated with cholesterosis, is not an essential factor and may be entirely absent. The relation of diet, of cholesterol metabolism, of cholesteremia, and of inflammation to cholesterosis and stone formation awaits further study.

CHARLES G. SUTHERLAND, M.B. (Tor.).

GASTRO-INTESTINAL TRACT (DIAGNOSIS)

Drugs as an Aid in Roentgen Examination of the Gastro-intestinal Tract. Max Ritvo. Am. Jour. Roentgenol. and Rad. Ther., December, 1936, 36, 868-874.

Spasm, atonicity, and inhibited peristalsis are all factors tending to interfere with prompt satisfactory examination of the gastro-intestinal tract by the roentgen method. Atropine and belladonna have long been recommended as aids to overcoming spasm, but these have been discarded as unsatisfactory by Ritvo. For increasing tonus and peristalsis, mecholyl (acetyl-beta-methyl-cholin), or physostigmine may be used. Mecholyl is not suited to clinical examinations because of unpleasant reactions, but physostigmine salicylate or sulphate in $\frac{1}{25}$ grain doses per mouth or about $\frac{1}{30}$ grain subcutaneously will increase peristalsis for from 15 to 30 minutes and increase tonus for an hour or more. Physostigmine should not be given in late pregnancy, advanced heart disease, or iritis.

To overcome spasm, particularly of the stomach, benzedrine sulphate in from 20 to 30 mg. doses administered orally, has been found very effective. For enema examination the colon injection may be greatly

facilitated by giving the drug from 15 to 30 minutes before commencing the examination. The administration of this drug is followed by a feeling of well-being but tends also to interfere with sleep for a few hours, hence it should not be given late in the afternoon. Because this drug produces a moderate rise in blood pressure, it should be withheld in cases of moderate or marked hypertension.

J. E. HABBE, M.D.

Allergic Gastritis and Allergic Pyloric Spasm. K. Hansen and M. Simonisen. Röntgenpraxis, March, 1937, 9, 145-151.

Gastric symptoms on a nutritive-allergic basis are caused by a hyperergic gastritis and pyloric spasm. Both are found every time a specific antigen against which an allergy exists is taken with the food. These antigens are often egg protein and milk. The allergic reaction of the stomach is very marked. It usually lasts only a short time and disappears soon after the elimination of the antigen. If the antigen is introduced into the stomach repeatedly for a long time, a chronic gastritis might result, to disappear only slowly after the beginning of an antigen-free diet.

Roentgenologic changes due to an allergic gastritis can be demonstrated readily, if the antigen is mixed with the barium meal. Some case reports illustrate the authors' contentions.

HANS W. HEFKE, M.D.

Radiologic Diagnosis in Two Cases of Intestinal Obstruction. LaMarque and Bétoulières. Bull. et Mém. Soc. Radiol. Méd. de France, January, 1937, 25, 29-31.

In the case of a man 68 years of age, with symptoms leading to a suspicion of gastric carcinoma, a barium meal made positive a diagnosis of crural hernia. The intestine was filled with fluid, and the usual gas shadows were absent.

In a second case presenting symptoms of obstruction, a gas-filled loop of intestine was found above the left diaphragm. The barium meal disclosed this to be the herniated splenic flexure and demonstrated a megacolon.

S. RICHARD BEATTY, M.D.

Diverticulum of the Duodenum after Operation. H. Albers. Deutsche med. Wchnschr., 1937, 63, 1111.

The author discusses briefly the clinical symptoms of diverticulum of the duodenum and then reports a case with a history of symptoms of 15 years' duration. The correct diagnosis was not made until then, following roentgen examination. Differential diagnosis, classification of diverticula, and the treatment are briefly discussed. Three roentgenograms are appended.

ERNST A. POHLE, M.D., Ph.D.

